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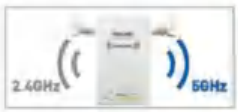


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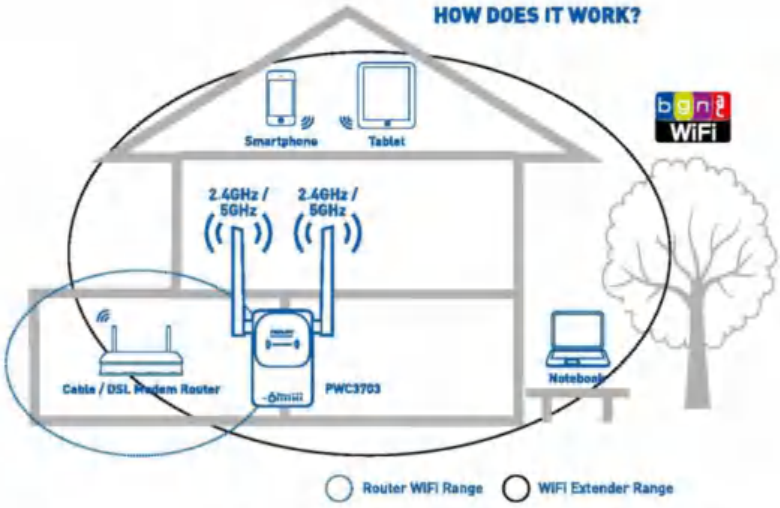


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ED'S NOTE

SEPTEMBER 2015



TECHNOLOGY: THE FINAL FRONTIER

In 2013, Dr. Paul Bunje, program director for energy and environment for the Wendy Schmidt Ocean Health XPRIZE and Alexandra Hall, senior director of the Google Lunar XPRIZE had a friendly debate during Mashable's annual Social Good Summit on which is the real final frontier: space or ocean exploration. Both are equally fascinating and alien. Both will greatly benefit mankind and the Earth.

However, Hall hits home with a point that, for most, is why space will always win. And it has nothing to do with scientific research or benefits; just our deep desire to understand the origin of Earth and the solar system.

As much as we have yet explored the depths of the Earth's oceans, we know one thing for certain. However vast and deep it is, the ocean is finite and contained within our planet. However alien the dwellers of the deep turn out to be, we are (probably, who am I to presume right? I read and watch movies too) not going to encounter an intelligent and advanced civilization just waiting under the seas for us to find them.

The ocean is part of the Earth, while the Earth is part of our solar system. And space? Space is infinite.

It might seem a little romanticized, but there has never been a more exciting time. Where space once belonged in the purview of governments, it has now been opened to private enterprise. Materials and equipment used for space travel were often termed "space-age" for being more advanced than consumer technology. Today, consumer technology is instead being harnessed to drive the next space age.

That is why, in this issue of HWM, our main stories focus not just on the new space race, but also look at the development of future and smart technologies that could one day power our homes…or the next space station.

Zachary Chan
EDITOR

axnasia

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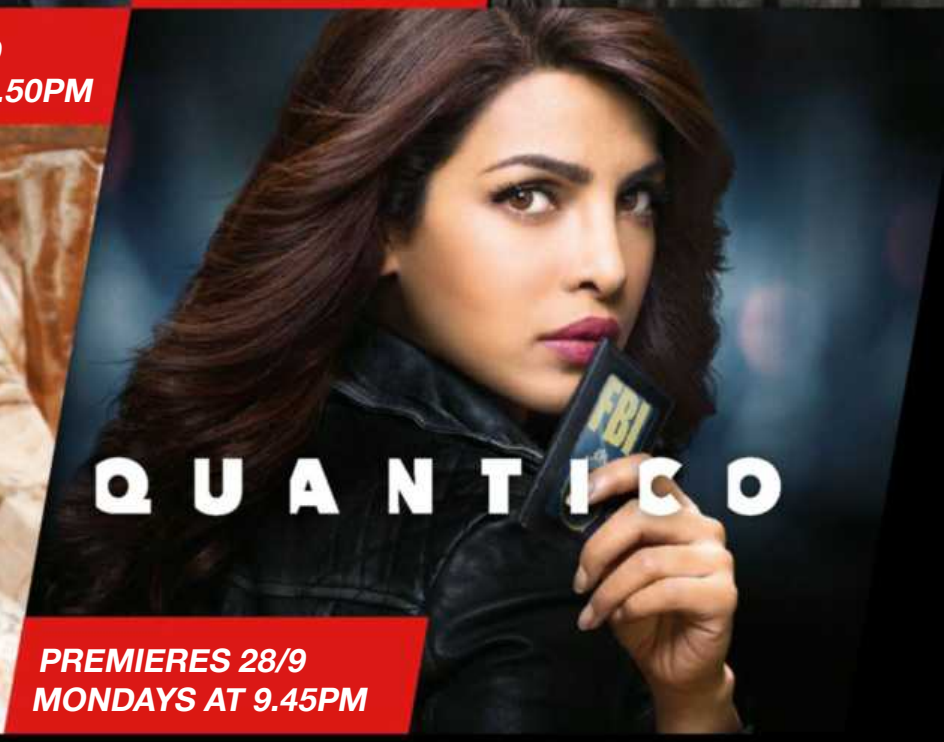
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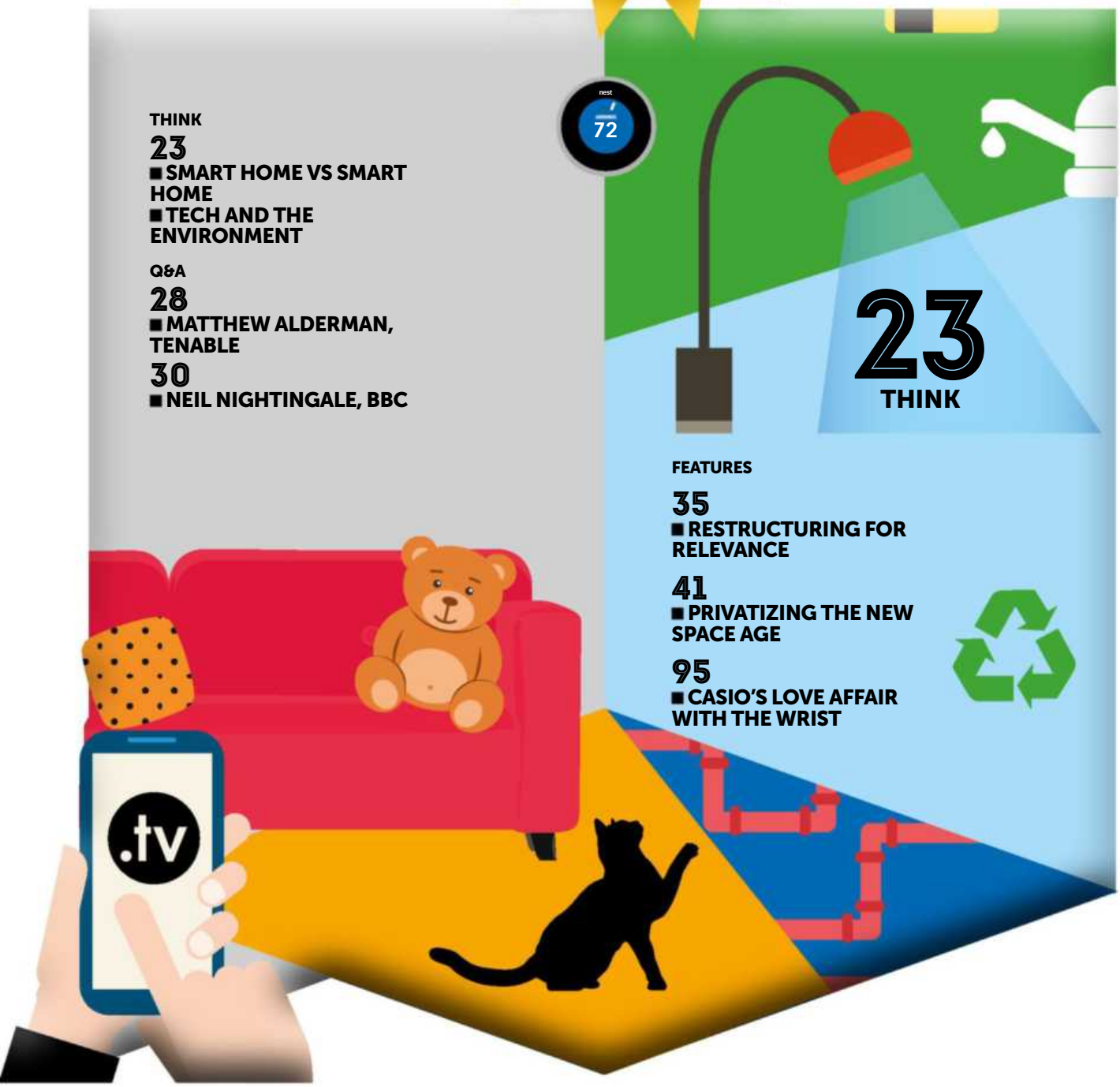
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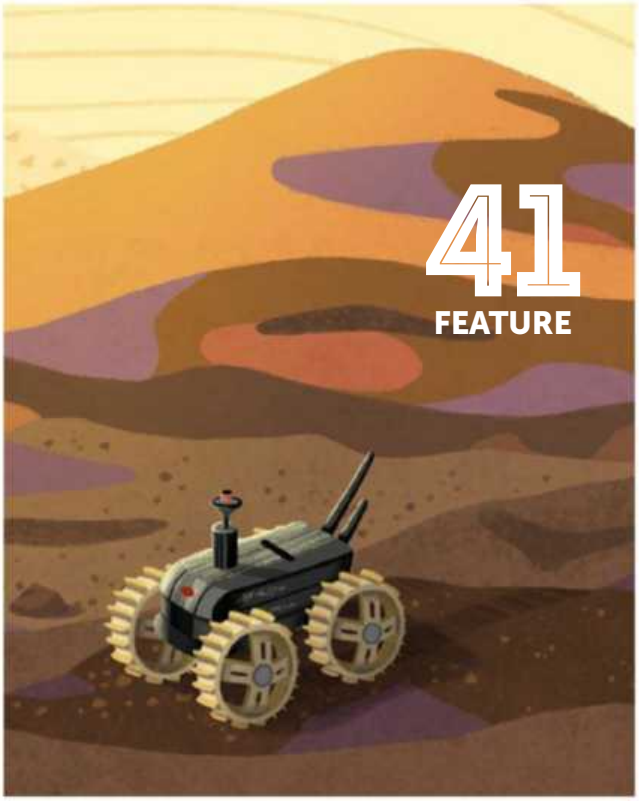
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ART DIRECTION AND DIGITAL IMAGING **KEN KOH**

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GROUP EDITOR-IN-CHIEF
CAROLINE NGUI nguislc@sph.com.sg

MANAGING DIRECTOR
JOSEPH LEE joelee@sph.com.sg

EDITORIAL
(editorial@hardwaremag.com)
Editor
ZACHARY CHAN zachchan@sph.com.sg
Deputy Editor
NG CHONG SENG csng@sph.com.sg
Associate Editor (Creative Services)
ALVIN SOON asoon@sph.com.sg
Associate Features Editor
JAMES LU jameslu@sph.com.sg
KENNY YEO kennyyeo@sph.com.sg
Senior Tech Writers
MARCUS WONG cmwong@sph.com.sg
Tech Writers
WONG CHUNG WEE wongcw@sph.com.sg
SALEHUDDIN HUSIN salh@sph.com.sg
KOH WANZI wzkoh@sph.com.sg
LIU HONGZUO liuhz@sph.com.sg

ADVERTISING SALES
(sales@hardwaremag.com)
Associate Ad Sales Director
IRENE TAN itan@sph.com.sg
Senior Account Manager
FION YIP fionyip@sph.com.sg
MICHELLE TAN mtancl@sph.com.sg
Account Manager
JENNIFER TAN seowping@sph.com.sg
CHIA LAI SAN lschia@sph.com.sg
JACQUELINE LIEW jacqliew@sph.com.sg
Account Executive
LOUIS KOH louiskoh@sph.com.sg

MARKETING
Executive
TEN HUI LING tenhl@sph.com.sg

EDITORIAL SUPPORT
Senior Manager, Administration and Editorial Support Unit
JULIANA CHONG julianac@sph.com.sg
Manager
ALICE HAN tayaha@sph.com.sg

PUBLISHING SERVICES
Team Head
ALICE CHEE siewyuen@sph.com.sg
Team Leader
LISA YONG lisayong@sph.com.sg

CREATIVE
(creative@hardwaremag.com)
Associate Creative Director
JAYSON ONG jaysono@sph.com.sg
Art Director
KEN KOH kenkoh@sph.com.sg
Graphic Designer
IAN CHONG ianchong@sph.com.sg
Chief Photographer
VERONICA TAY verontay@sph.com.sg
Executive Photographers
FRENCHESCAR LIM frenchl@sph.com.sg
TAN WEI TE tanweite@sph.com.sg
Photographers
DARREN CHANG darrenc@sph.com.sg
JASPER YU jasperyu@sph.com.sg
VEE CHIN veechin@sph.com.sg
VERNON WONG vernwong@sph.com.sg
WINSTON CHUANG wchuang@sph.com.sg
ZAPHS ZHANG teolc@sph.com.sg
Photography Assistant
CHERYL RAHARJO craharjo@sph.com.sg
Editorial Support Executive
JACQUELINE YIK jacyik@sph.com.sg

SPHmagazines

CHIEF EXECUTIVE OFFICER
LOH YEW SENG lohys@sph.com.sg

STRATEGIC DEVELOPMENT DIRECTOR
FOONG SEONG KHONG foongsk@sph.com.sg

PUBLISHING SERVICES DIRECTOR
LEONG TSCHENG YEE leongty@sph.com.sg

CORPORATE COMMUNICATIONS HEAD
CHIN SOO FANG soofang@sph.com.sg

VICE PRESIDENT, HUMAN RESOURCES
IRENE LEE leebl@sph.com.sg

INTERNATIONAL OFFICES

Indonesia Rep. Office
Martin Wijaya (Chief Editor)
Jl. Palmerah Utara no. 55
Jakarta Barat 11910
Jakarta, Indonesia
Tel: (62) 21 5366 7777
Fax: (62) 21 6220 2580
Email: info.id@hwzcorp.com

Malaysia Rep. Office
Michael Low (Editor)
Lot 7, Jalan Bersatu 13/4,
section 13 46200 Petaling Jaya
Selangor, Malaysia
Tel: (60) 3 7952 7000
Fax: (60) 3 7960 0148
Email: sales.my@hwzcorp.com

Philippines Rep. Office
Marvin R. Velasco (Editor)
Unit B-2, Topy Main Building, No. 3
Economia Street, Bagumbayan,
Quezon City 1110, Philippines
Tel: (63) 2634 9179
Fax: (63) 2634 9180
Email: sales.ph@hwzcorp.com

Taiwan Rep. Office
Dennis Chou (Asia Media Contact)
2F-2, No.35, Sec 2,
Fushing South Road,
Taipei 106, Taiwan
Tel: 886-2-8773-4199
Fax: 886-2-8773-4200
Email: sales.tw@hwzcorp.com

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NEW THIS MONTH

Every month, we receive dozens of product announcements and mentions, sit through many a launch event and try out all kinds devices. All these products are then carefully curated by our crack team of tech gurus. The final list is presented here in Gear and it is our hope you'll find something to geek-out to.



MORE INSIDE>

SONY SMART B-TRAINER
All-in smart wearable for the active user.

CREATIVE SOUND BLASTER FREE
Rugged audio gets a new player.

XIAOMI MI TV 2S
A compelling smart TV this.

MB&F MUSICMACHINE 3
Channeling the dark side of the Force.

GOPRO HERO+ LCD

With the Hero+ LCD, GoPro has answered the call of fans who want an easier way to frame and review shots into the standard GoPro design. In fact, they've even added video trimming capabilities to the Hero+ LCD, so you can now make basic cuts to your videos directly in-camera and share them without needing a computer.

PICTURE GOPRO

LG MAGNA LTE

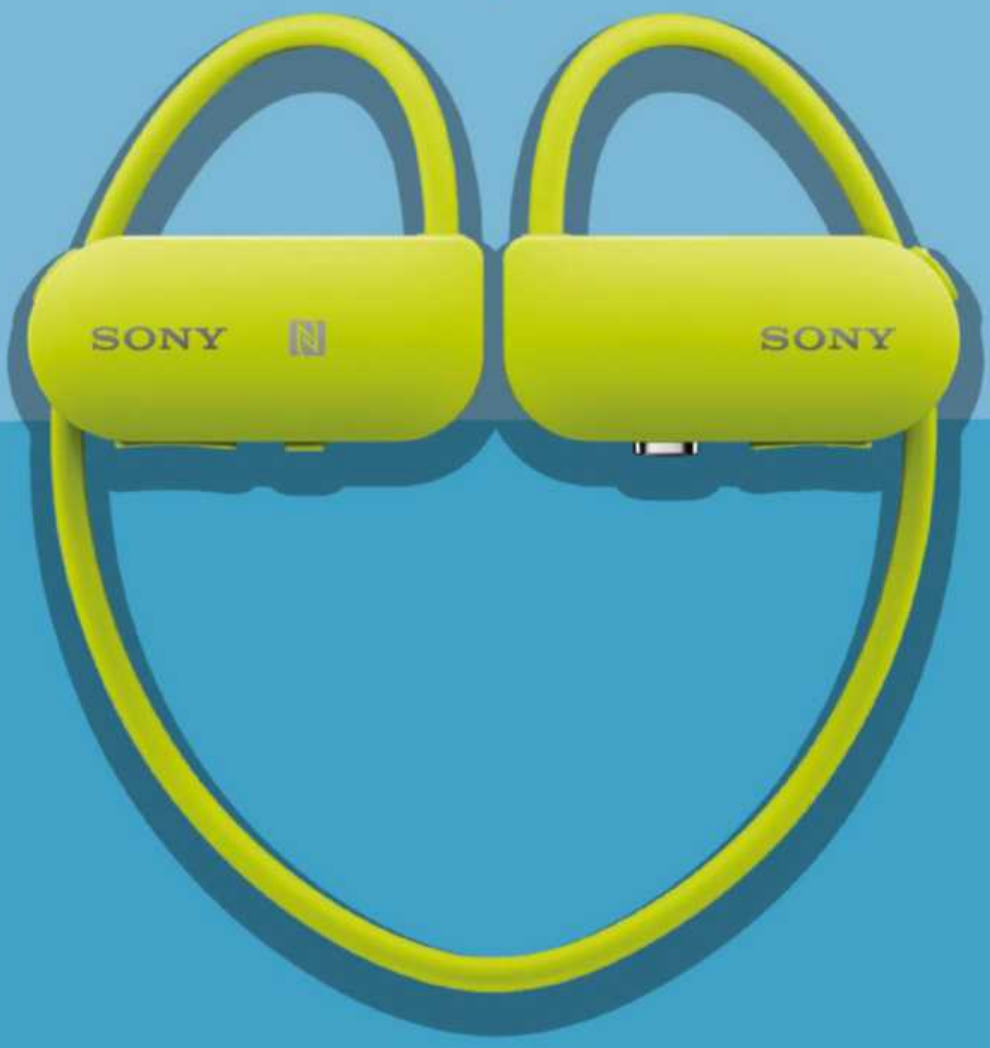
The 5-inch LG Magna is a mid-range device that sports a slightly curved ergonomic design as well as the rear button design of LG's flagship G4 smartphone. In addition, LG has also included a number of UI features originally designed for its premium smartphones, including Gesture Shot and Glance View.



PICTURE LG

SONY SMART B-TRAINER

Take your workout to the next level with the Sony Smart B-Trainer, which offers 16GB of memory to load your favorite workout songs, IPX5/IPX8 waterproof rating and six built-in sensors to measure and record a variety of stats such as heart rate, calories burnt, distance, pace, cadence and route. It can also provide audio feedback and coaching via its companion app.



PICTURE **SONY**



EPSON L655

With a printing cost of $0.0032 per page for black-and-white and $0.004 per page for color, the $539 Epson L655 ink tank system printer targets businesses that print a lot. The company's latest Precision Core printhead tech and pigment black ink also combined to give you water and smudge-resistant mono prints and lab-quality photos on photo media.

PICTURE **EPSON**

MB&F MUSIC MACHINE 3

It's hard to look at MB&F's latest music box and not think of the TIE fighter from Star Wars. This music box was built to commemorate the 10th anniversary of MB&F and is designed and built in collaboration with Reuge, one of Switzerland's top luxury music box makers, and JMC Lutherie, a maker of soundboard speakers. The MusicMachine 3 plays tunes from Star Wars, Mission Impossible, James Bond, The Godfather and more.



PICTURE **MB&F**

NIKON AF-S NIKKOR 500MM F/4E

Thanks to the use of magnesium alloy in the barrel, the new AF-S NIKKOR 500MM F/4E FL ED VR is some 790g lighter than the previous version, making it significantly easier to bring around. When matched with Extra-low Dispersion Glass and Nikon's Nano Crystal coating to complement the Fluorite lens elements, you can expect superb telephoto images.



PICTURE NIKON



HP PAVILION X2 (2015)

The HP Pavilion X2 has been refreshed to include a host of new features fit for 2015. It is powered by a quad-core Intel Atom Z3736F processor with 2GB of RAM and up to 64GB of eMMC storage. In addition, it is poised to take advantage of next-generation peripherals with a USB Type-C connector. As a 2-in-1 hybrid device, it also has a detachable 10-inch 1,920 x 1,080 pixel resolution IPS touchscreen display.

PICTURE **HP**



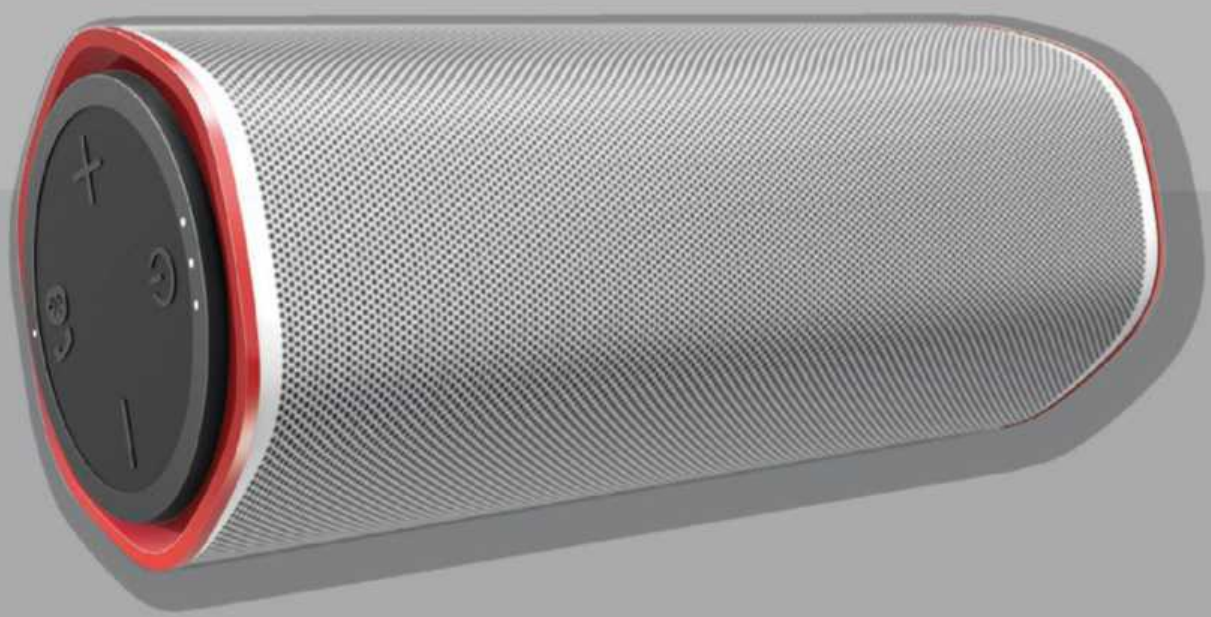
SONY RX10 II

With a focal length of 24-200 (35mm equivalent) and a bright constant f/2.8 aperture throughout the zoom range, the RX10 II offers a great compact option for nature photographers, especially when you consider it comes with the incredible ability to shoot up to 40x Super Slow Motion video with shutter speeds up to 1/32,000s.

PICTURE **SONY**

CREATIVE SOUND BLASTER FREE

The Sound Blaster FRee is built to work in both vertical and horizontal orientations, projecting sound 360-degrees for all-around audio. Weighing just 466g and measuring just 71.1 x 200.8 x 68.5mm, it's also highly portable and the IPX4 splash resistance means you can bring it to pool parties and the beach side. Just don't drop it into the pool itself.





XIAOMI MI TV 2S

Priced at around $660, the Mi TV 2S is a super-slim 48-inch 4K UHD TV powered by an MStar 6A928 quad-core 1.4GHz processor, runs MIUI TV OS (based on Android 5.0), and comes with 2GB RAM, 8GB storage, plus support for 802.11ac Wi-Fi and Bluetooth 4.0. There's even an elegant power plug co-designed with Volex. Too bad it's only available in China.

PICTURE **XIAOMI**

BOWERS & WILKINS P5 WIRELESS

Bowers & Wilkins have taken their popular P5 headphones and added wireless capabilities,meaning you can now enjoy the same luxe experience with the hassle of wires. Apt-X support makes for a quality Bluetooth streaming experience, while the internal battery supports up to 17 hours of playback, with three-button controls built in so you can pause,skip tracks, and take calls.



PICTURE **BOWERS & WILKINS**

SECOND SKIN

Joining the ranks of the thinnest iPhone 6 cover of all time, is the all new Veil XT line from Caudabe. Measuring just 0.35mm in thickness, this case hugs your smartphone snugly like a second skin, while still providing enough protection against minor bumps and scratches. It even has a thicker 0.7mm ridge round the camera cut-out to help protect the protruding lens of your iPhone 6 and 6 Plus. **The Veil XT**



QUALITY DX

Weighing in at just 480g, the AF-S DX NIKKOR 16-80MM f/2.8-4E ED VR is currently the world's lightest DX-format 16-80mm, 5x normal zoom lens. And it features a combination of three superior optical elements: Nano Crystal Coat, aspherical lens, and Extra-low Dispersion (ED) lens elements for optimal image quality. **Nikon AF-S DX Nikkor 16-80 f/2.8-4 ED VR**







DESIGNER GAMEPAD

The Kem Studio S1 is a gamepad designed for adult sensibilities. With its aluminium base and tasteful walnut face, the S1 shows that gaming doesn't have to be about aggressive designs and flashing LEDs. Adjustable-height joysticks let you choose the most comfortable setup and its buttons are lovingly textured with a rough finish for a more tactile experience. With a full complement of trigger buttons and controls, The S1 merges complete gaming experience with understated elegance. **Kem Studio S1**

X MARKS THE FURY

The ASUS R9 Fury X graphics card is powered by the new AMD Radeon R9 Fury X GPU, with a peak compute performance of 8.60 TFLOPS. In terms of video memory, the card has 4GB of High Bandwidth Memory (HBM) that promises significant improvements in power consumption and performance. The card features a closed-loop liquid cooling system that operates quieter than a typical air-cooling solution. **ASUS R9 Fury X**

PICTURES THE VEIL, NIKON, KEM STUDIO, ASUS

FLOATING MUSIC

The Superstar Backfloat is the latest portable speaker from Monster, and it does something new that not many of its competitors can - float on water, albeit only in relatively calm bodies of water like a siwmming pool or a jacuzzi tub. The speaker can also double up as a hands-free kit, allowing you to take calls anywhere from the office to the pool side. **Monster Superstar Backfloat**

SOUPED-UP COOLER

The Coolest is a cooler that keeps your drinks cold, and more; it has separate storage for dining ware and other kitchen tools. It's also pretty smart, with a built-in battery that powers an onboard blender. The battery can also be used to recharge portable devices via USB, plus it even has an integrated, removable and waterproof wireless speaker for setting the party mood. **Coolest Cooler**









A GOD IS BORN

It looks like extravagance has a new name – the MSI X99A Godlike Gaming. MSI's new Intel X99 motherboard is chock full of enthusiast features like four-way NVIDIA SLI and AMD CrossFire support, Nahimic sound technology, and Killer DoubleShot-X3 Pro networking, which allows smart teaming of two Ethernet chips and a Wi-Fi module. In addition, an onboard RGB LED lighting system called Mystic Light lets you customize a wide variety of colors and lighting effects. **MSI X99A Godlike Gaming**

JUICE UP YOUR BATTERIES

Batteriser is a thin stainless steel sleeve that fits over a standard battery to extend its usable life. Using microcircuitry for intelligent voltage management, its inventors claim Batteriser is able to "tap into" unused portion of the battery. Some of its claims seem too good to be true, but we'd love to be given a chance to actually prove or debunk this little invention. **Batteriser**

PICTURES **MONSTER, COOLEST, MSI, BATTERISER**

GET JUICED QUICK

What else can portable battery banks do to impress us? Well, incorporating Qualcomm's Quick Charge 2.0 technology is certainly a start. The technology offers super-fast charging for users with Qualcomm Quick Charge 2.0 compatible devices, bringing it up to 50% charge in just 30 minutes. For non-compatible devices, the CP-R10 offers a 5V 2.0A output so you can still tap into its 10,000mAh of power. **Sony CP-R10 USB portable charger**

A UNIVERSAL COMPANION

The Universal Mobile Foldable keyboard is built off Microsoft's Type Cover keyboard and features a foldable crease down the middle. The keyboard pairs via Bluetooth with any mobile device running on Windows Phone, Android or iOS. Two Bluetooth buttons let you pair the board with a particular device, so you can easily connect the keyboard to both your phone and tablet. As the functionality of mobile devices continues to grow, a mobile keyboard like this one could help you be more productive. **Microsoft Universal Foldable Keyboard**











SCANNING PERFECTION

Equipped with a built-in kickstand, the small and lightweight Epson Perfection V39 scanner features four one-touch buttons and powerful document capture software, making working with scanned documents a breeze. Under the hood, it uses Epson's ReadyScan LED technology, which means no warm up time is required. **Epson Perfection V39**

SELFIES NEVER LOOK BETTER

The ASUS LolliFlash is a compact dual-tone LED fill light compatible with just about any smartphone. With additional lighting, you can get skin tones that look perfect in every photo. The LolliFlash also comes with multi-colored interchangeable filters that allow you to create different lighting colors with adjustable intensity levels. It can work plugged in or detached from your phone too. Go on, embrace the narcissist in you! **ASUS LolliFlash**

PICTURES SONY, MICROSOFT, EPSON, ASUS

AN EXTRA DIGIT

It looks like there really is a device for everything. Targeted at mobile gamers, 6thfinger is a tiny device that interacts with a capacitive touchscreen just like you would. The 35g aluminium device taps and turns the screen in a random pattern so your mobile game remains active even while you're away. Many mobile games involve automatic battle sequences and the like, so we can definitely see hardcore mobile gamers welcoming this sixth finger into their lives. **6thfinger**

MOMENTUM GOES WIRELESS

At first glance, the Momentum Wireless range may look exactly like the cabled versions, but these new models come with plenty of updates within, with apt-X streaming support for CD-quality sound, and NFC for easy pairing as well as noise-cancelling capabilities. Top that off with the larger and more comfortable Alcantara earpads, and you've got yet another fantastic offering from Sennheiser. **Sennheiser Momentum Wireless**



DRONE IN YOUR PALM

Drones don't have to be these large, unwieldy things that you're afraid of flying into someone. The Micro Drone 3.0 fits in your palm and features a modular design for greater customizability and expansion. Its onboard sensors work together for a stable flight and you can send up to 720p video at 30fps to your smartphone. It's also self-correcting and can withstand winds of around 70km/h, so expect less zig-zagging into trees. **Micro Drone 3.0**

PC GAMING ON A CONSOLE

If you're an FPS gamer, a gamepad is generally seen as a poor tool compared to a keyboard and mouse. Hori's Tactical Assault Commander 4 for the PS4 to the rescue then. The DualShock 4's left analog stick is mapped to arrow keys, while the right analog is ported over to a mouse. The remaining buttons are accounted for by additional keys on the D-pad/mouse combo, and there's even a "snipe mode" button that changes mouse sensitivity on-the-fly. **Tactical Assault Commander 4**

PICTURES 6THFINGER, SENNHEISER, VERNON KERSWELL, HORI

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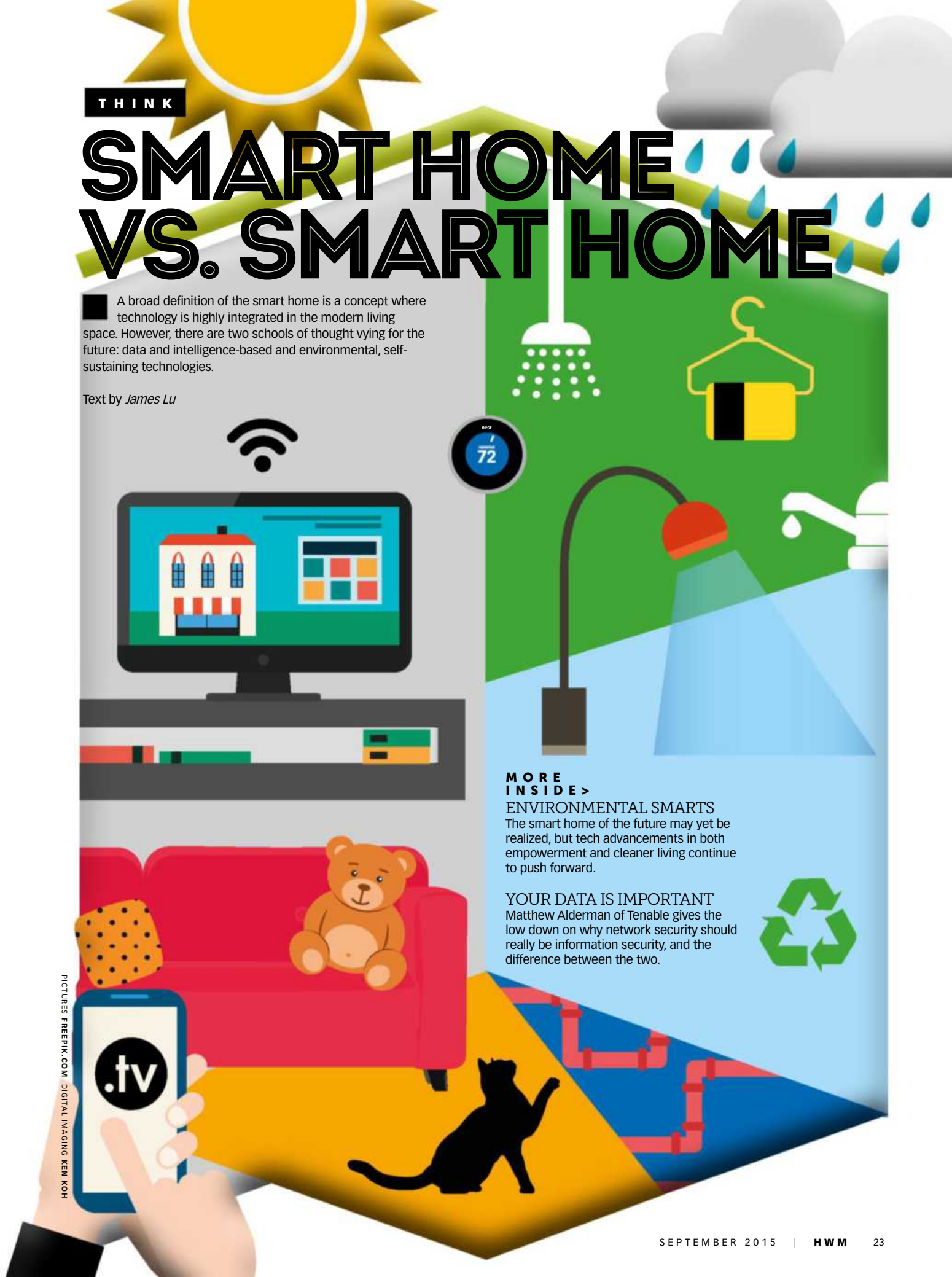
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THINK

SMART HOME VS. SMART HOME

A broad definition of the smart home is a concept where technology is highly integrated in the modern living space. However, there are two schools of thought vying for the future: data and intelligence-based and environmental, self-sustaining technologies.

Text by *James Lu*



MORE INSIDE>

ENVIRONMENTAL SMARTS
The smart home of the future may yet be realized, but tech advancements in both empowerment and cleaner living continue to push forward.

YOUR DATA IS IMPORTANT
Matthew Alderman of Tenable gives the low down on why network security should really be information security, and the difference between the two.

PICTURES **FREEPIK.COM** DIGITAL IMAGING **KEN KOH**

THE HOME THAT KNOWS MORE ABOUT YOU THAN YOU DO

Your smartphone is more than just a device to make phone calls. What if every device in your home was smart?

by *James Lu*

What kind of home will you be living in a decade from now? Companies like Qualcomm, Intel and Google will have you believe that the next big advancement in the home is deep integration with the internet. After all, they've spent vast amounts of money pushing the Internet of Things as the next big thing.

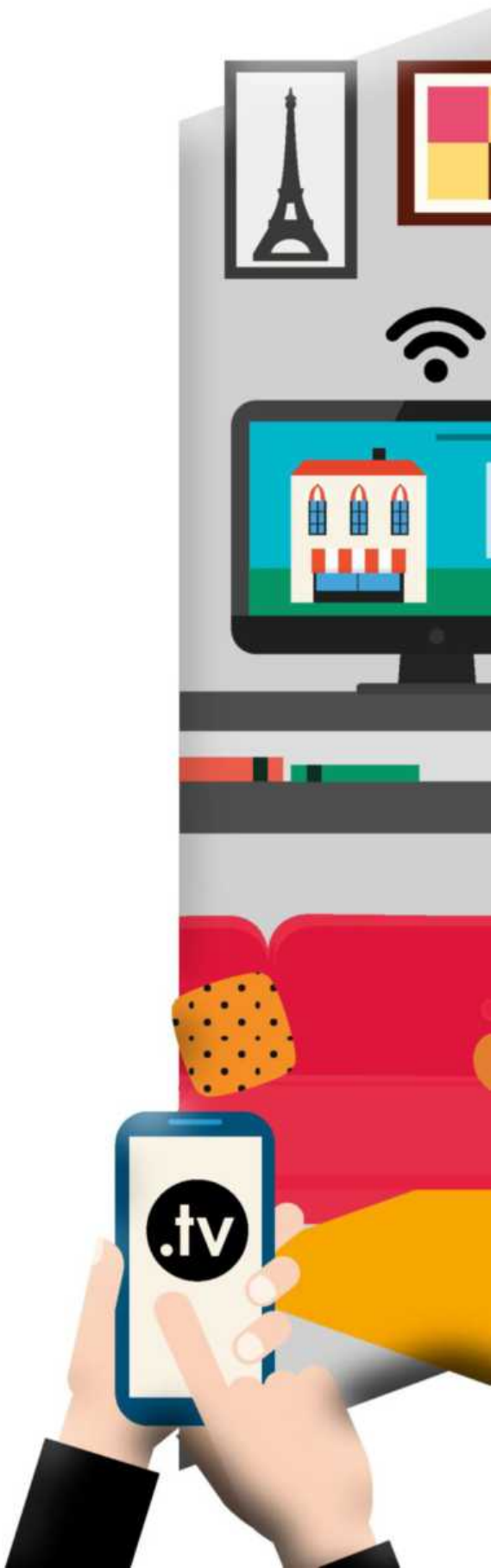
The Connected Smart Home concept is based on utilizing advancements in network connectivity to let gadgets like media streaming players and smart TVs, appliances like washing machines and microwaves, and fixtures like light bulbs, thermostats and doorknobs all communicate and talk to each other. The connected smart home works in harmony with each of its individual devices to make life for the home owner more convenient, comfortable and efficient.

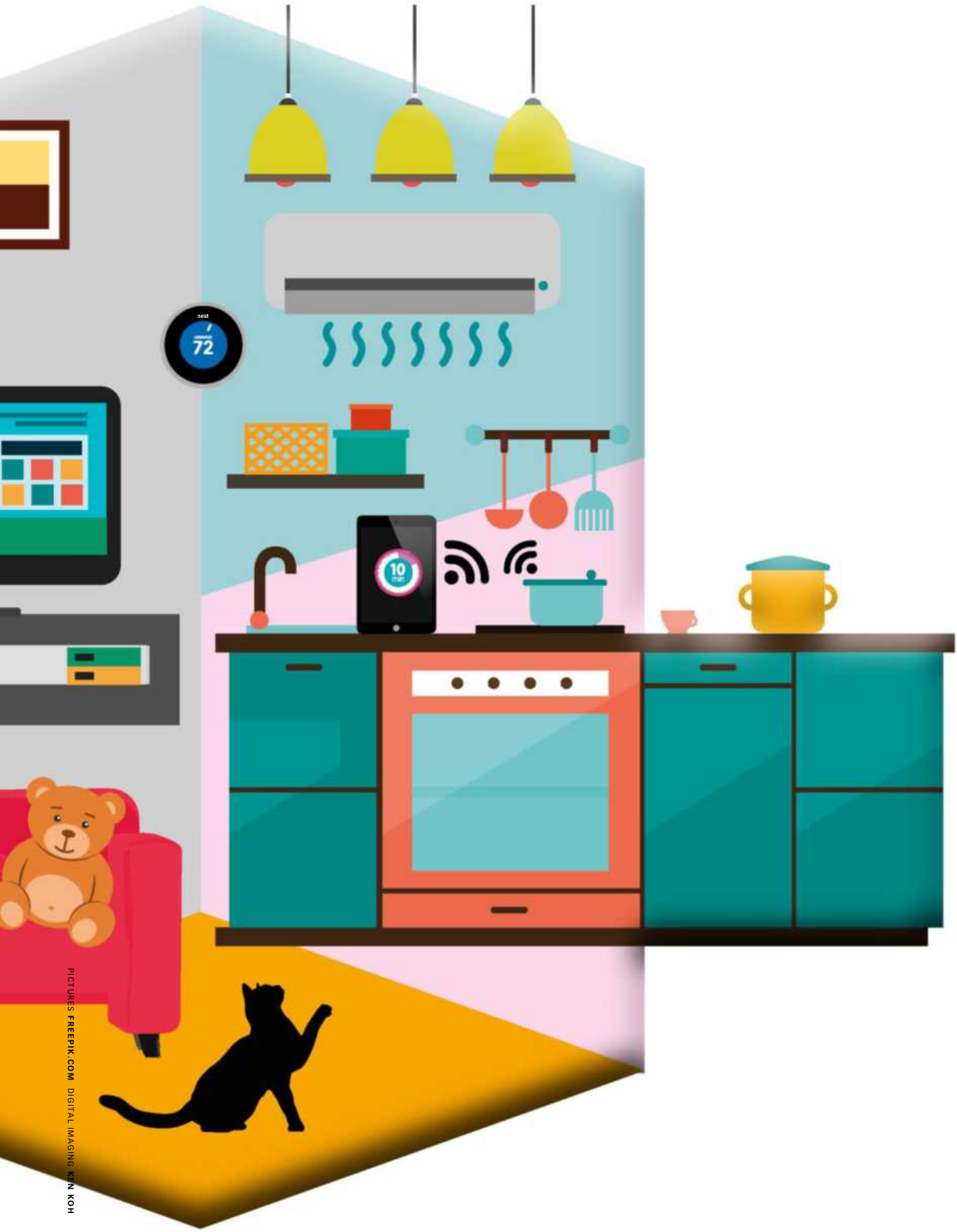
Nest, one of the most well-known smart home startups, (they were purchased by Google last year for US$3.2 billion) makes one of the most popular IoT devices currently available. A thermostat may seem like a simple device, but in a connected smart home it becomes much more. The Nest Smart Thermostat is a Wi-Fi connected thermostat with an array of sensors that primarily monitors the temperature inside your house. You can operate it manually via a touchscreen, or through a smartphone or tablet via an app. What makes Nest special isn't its connectivity – after all, remotely changing the temperature inside your house while you're not actually there only has limited appeal – but the fact that it's smart enough to learn about you and your habits. The device automatically tracks your temperature adjustments and your daily routine, so if you always come home at around 9PM it will know to start adjusting the temperature to your ideal setting a few minutes before you arrive. It knows when you're not at home too, even when you're not sticking to your usual usage pattern, so if you spontaneously decide to spend Saturday afternoon out, it's smart enough to turn the air con off to save you electricity and money.

> "The connected smart home works in harmony with each of its individual devices to make life for the home owner more convenient, comfortable and efficient."

Nest is just one example of what a connected smart home can do. Imagine if every room in your house was fitted with gadgets as smart as Nest. Smart beds will monitor your sleep patterns and heart rate, only waking you when you're in a light sleep cycle, while smart washing machines with sensors for load size, degree of dirt and soiling, amount of water, and detergent required will take all the hassle out of washing your clothes. Surely, all signs point to the connected smart home being the home of the future.

But what if it isn't?





PICTURES **FREEPIK.COM** DIGITAL IMAGING **KEN KOH**





PICTURES FREEPIK.COM DIGITAL IMAGING KEN KOH

LIVING SMART OFF THE GRID

Because, what happens to your smart devices if the power grid goes down?

by *James Lu*

Away from Silicon Valley, a few companies are developing a very different kind of smart home: the Sustainable Smart Home.

Japanese automobile manufacturer, Honda, is at the forefront of this alternative approach. Its HSHS (Honda Smart Home System) is built to provide total self-reliance, and features a line-up of innovative energy production, management and conservation solutions, which the company hopes will free homeowners from the reliance of on-grid power supply.

Two model homes, one in California, USA, and another in Saitama, Japan have been built to test the concept. Included in each house is a 9.5kW solar cell system mounted on the roof, a co-generation system driven by a specially-designed high-expansion-ratio engine, which provides combined power generation and heat recovery efficiencies of up to 92-percent, a high capacity battery that stores all energy produced plus a central control hub called the Smart e Mix Manager that ties everything together.

"Japanese automobile manufacturer, Honda, is at the forefront of this alternative approach. Its HSHS (Honda Smart Home System) is built to provide total self-reliance, and features a line-up of innovative energy production, management and conservation solutions."

A geothermal heat pump provides the house with hot water, as well as its temperature control. Water is heated in a tank and delivered to the shower. As the shower drains, the water is re-used to help preheat the reserve water tank, reducing the energy required to provide hot water to the home. Once it has fulfilled its hot water duties, the water drains into four underground thermal tanks. Here, heat from the earth warms the liquid further, turning it into what the team calls Ground Source Fluid. This fluid is then returned to the house and driven through pipes located in the floor, roof and ceiling to provide heating. Alternatively, cold water can be pumped through the system to cool the house in the summer months.

On top of optimizing home energy use, the HSHS will alert the homeowner of lights and utilities that could be turned off before leaving, allow voice-recognition remote control of appliances from on the road (with Honda's Internavi in-car telematics system) and provide real-time feedback on all components.

All of these factors result in a home that Honda says is three times more water-efficient and uses half the energy of similar-sized homes in the US and Japan. A typical home of this size will use around 13.3MWh of electricity per year, but the Honda smart home actually generates a surplus of 2.6MWh. Honda says this equates to an offset in carbon emissions of nearly 5,942kg per year. This excess energy can actually be sold back to the power grid, earning the homeowner some extra money.

Future plans might add a water filtration system too, which would collect rain and dew to allow for a self-reliant water source. There's also the possibility of additional wind turbines to complement the solar panels.

Honda has plans for construction of additional homes and will continue testing and refining the system until at least 2018, when it estimates that consumers may be able to purchase and live in one. And that estimation, is only three years away.

Individuals are the keys to security

MATTHEW ALDERMAN, VICE PRESIDENT OF STRATEGY, GLOBAL, TENABLE NETWORK SECURITY

by *Marcus Wong*

For starters, what's the difference between "Cyber security" and "Network security"?

That's interesting because I've never actually thought about it that way. I don't actually use that term; I don't like it because it implies certain connotations.

"Network security" is probably closer, but I think it's more "Information security" when you think about it. What is it that we're trying to protect? We're trying to protect information and that information happens to live on a network or in the internet and so when you define security holistically, "network" is a part of it, but there are a lot of other pieces to that puzzle.

How real are threats to enterprises and individuals, and what are the main difficulties to preventing these threats?

Definitely the threats are real. There's no doubt about that. I think it starts with the individual. If you look at what the traditional sophisticated attack has done, it starts with an individual – it's a phishing attack, it's some sort of social engineering that starts the majority of the breaches we see around the world.

So it's getting people to trade convenience for security. But also how much we can count on authentication methods that rely on human memory isn't it?

Right, because if they write it down on a post-it and place it on the screen, there's no point. We have to find a way to make it easier, and one of the things that have been brought up is: how do you link the identity to who you are as a person? Whether it's biometrics, finger prints, retina, these are things that are with you that identify you uniquely versus a passcode or phrase that you have to try to remember.

What Apple's done with Touch ID is very interesting. It's very easy to get to your phone now, and I think it's at a convenience level that people will use. So we definitely have to have those balances.

That said, what are some of the misconceptions that organizations and institutions have regarding risks and management compliance?

The biggest is that we think we're not susceptible to being compromised. I think the first assumption that we have to make is that: we have data that is valuable and someone is going to want it. Period.

That means we have to value information more. If we look at the way we spend on security as a portion of the IT budget, it's not equivalent to the value of the data that you're trying to protect. So the first mistake that I think everybody makes is not recognizing the value of the data you're trying to protect and therefore not spending enough to protect it.

Everyone has to understand that yes, your information is valuable, and yes, someone is going to come after it, and you're going to have to spend money to protect it.

Compliance is slightly different. Compliance is a mandate that says: "Thou shalt do a number of things"…

And you will be safe?

And you will be safe! But "compliance" does not equal "security". If we've learnt nothing else from breaches so far, it's that we've turned security into a "check box" mentality. We deploy solutions to meet the letter of the law and not the spirit of the law. And I think that's a mistake when it comes to what we've done on compliance.

Compliance has its place, but we have to understand that compliance does not equate to security. I think a better solution would be to build a holistic security program where compliance is an outcome of the program. So, "security" could equal "compliance" but not the other way around.

How can the average person contribute in terms of cyber security when even governments and large enterprises are struggling?

It's… difficult. Because human beings are lazy. Right? We want what we want and we don't want to have to think about security. And we've almost made it ok for people not to have to worry about security.

For example: In the States, if you lose your credit card, it costs you nothing financially. We've put in place protection measures for the individuals so they don't care. If there's no impact to me as an individual, why would I change? So, very few people feel the impact of security breaches for example, and because of that, we're not very likely to change.



I think the first assumption that we have to make is that: we have data that is valuable and someone is going to want it. Period.

PHOTOGRAPHY **DARREN CHANG** ART DIRECTION **KEN KOH**



> …in a few years' time, probably your smart phone will be as good as the top of the range cinema-quality cameras, and that's very exciting.

The challenges to TV programming today.

NEIL NIGHTINGALE, CREATIVE DIRECTOR, BBC EARTH

by *Marcus Wong*

How would you describe today's 'television' programming and the challenges television faces from the likes of OTT and On-demand players?

Well, the television world now is so diverse that I think the most important thing, whether it's television, OTT or streaming services, is having really great content. Be it great stories or great visuals, we simply have to find the best way to get those out to the audience. So the variety of different ways that audiences now tap into content is a great thing, because it just means you can reach more people in more different ways with fantastic stories.

Have you found that new technologies give you better access to people now?

Well technology is incredibly important; it always has been in film-making. Now you can film great stories on everything - from your mobile phone to a cinema-quality camera. In fact, in a few years' time, probably movies from your smart phone will be as good as the top of the range cinema-quality cameras, and that's very exciting.

Tech allows you to get amazing stories; great content from all kinds of different sources. For example, on our website now we have a downloadable app called Earth Capture where people can – from wherever they are - upload short videos to our website, so we have a great connection now with our audience in ways that we just couldn't have had before.

How would you say the demands of your audience have changed? As you have more tech, do you have more expectations?

I think audiences now are incredibly demanding, and I always think of audiences almost like addicts – you know, you give them something new and that's fine this time, but then they want something else new and something better, and better…

And so, if I had to come up with one word to sum up what we're always going to do, it's that we're always trying to surprise audiences. With new places, new animals, new stories, new behavior, new perspectives… and we research the world to bring new stories. And then of course, technology is very important. One of the trends at the moment in wildlife films is ever-greater immersion; putting audiences at the heart of the action, and the new digital cameras that we're using now allow us to do that in ways that the film cameras that we were using could never do.

Because they're miniaturized, they allow us to pretty much put cameras wherever we want to in relation to our subjects. So we're able to be with animals, trek with animals, trek through landscapes and the environment in ways that we could never do before. But what's really important is that you don't just do that gratuitously. You do it in the service of the story, so that you are able to give your audience an insight into your subject and the stories that you are telling.

What's the key to providing cinematic quality to television?

I think two things: one is dramatic story telling and characterization. And that means emotionally engaging with your subjects, with your characters; telling stories in an emotional, engaging, and dramatic way. And then the other is immersing the audience – getting close to the action so that the visuals complement the immersive story-telling.

What are the "most" essential tech tools that you pack for film-making of this nature?

laughs Well I think the most essential tools that you pack are: a lot of patience, a lot of determination, and a sense of humor, because ultimately, whatever technology you're using it comes down to us. It comes down to the human being. Shooting nature is difficult! So it's the humans; it's the team you take with you that is the most important thing you pack for a nature shoot.

The one tip for an amateur nature film maker trying to do some nature films?

The great thing today is that we can now shoot nature films with "consumer" technology. There are so many great digital cameras that shoot HD quality. Even your mobile phone can shoot nature films! So, it's (about) finding a subject that you're passionate about that you can access and shooting it again and again, in different ways.

PICTURE BBC

A GREENER REVOLUTION: ENERGIZING THE FUTURE WITH TECH

by *Koh Wanzi*

The rise of high technology has alternately been mankind's greatest crutch or boon. It's easy to get swept up in this giddy wave of cool advances in technology. With news of delivery drones, artificial neural networks and too-smart digital assistants dominating the headlines, it's difficult to see how any of this could be bad. And it isn't, really.

But as we gaze starry-eyed at virtual worlds and zoom in on microscopic transistors, it can almost appear like all this is taking place in a vacuum. It doesn't, and the technological revolution could either help kickstart newer and greener ways to power our world, or serve as yet another source of emissions to warm the planet. We take a look at both sides of the coin.



Home Batteries

Powerwall is a wall-mounted lithium-ion battery that can store energy from the grid or rooftop solar panels. There are two models – a 10kWh one for backup applications and a 7kWh one for daily use. It is intended to work in tandem with a solar panel and an electrical inverter (converts DC to AC current) to store surplus energy from solar panels and even utility grids.

It's being billed as a way for solar power to finally become feasible. Previously, solar power ran into the problem of how to power homes at night, which made it impractical for homes to be fully dependent on it. One of the key hurdles to more widespread adoption of renewable energy has been its inability to be generated on-demand. But the ability to store the energy in batteries like the Powerwall could sweep aside such arguments and make it possible for entire electric power grids to be constructed based on millions of these units.

At least, that's the vision of Elon Musk. The Tesla CEO said that 160 million of these units could replicate the power grid of the U.S., and two billion such units could power the world.



There's even a commercial system offering 100kWh of storage. 100 units of these can be stacked to form a 10 megawatt-hour unit to be used on the scale of small electricity grids. The home-based units can be installed together to create micro electrical grids as well.

Of course, the Powerwall isn't ushering in an energy revolution just yet. Existing net-metering rates in the U.S. allow customers with solar panels installed to sell excess energy back to the grid. It thus makes more financial sense for them to send electricity directly back to the grid rather than storing it, especially when a paper published in the journal Energy Policy recently found that staying connected to conventional electrical grids was still cheaper.

But home batteries are by no means a failed project. Tesla's Powerwall is sold out through the middle of 2016, so demand and interest is definitely there. They're just a hair ahead of the times, and when existing market frameworks and incentives catch-up, they could be part of a new era of widespread reliance on renewables.

PICTURES UNSPLASH, TESLA

Solar Walkways

Last year, the Netherlands became the first country to build a solar road – a bike path paved with glass-coated solar panels. In May, reports emerged that the road was working even better than expected, generating 3,000kWh over six months, enough to power a small household for a year. SolaRoad, the group behind the Netherlands project, estimates that similar installations could generate more than 70kWh per square meter per year.

Here's some perspective: the Netherlands bike path was just 70m, but in 2012, the US had over 6.5 million km of roadways. In 2013, India's road network spanned over 4.5 million km. If even just a fraction of these could be turned into areas for harvesting solar energy, the potential could be limitless.

SolaRoad's bike path sandwiched the solar panels between glass, silicon rubber and concrete, and are strong enough to support up to 12-ton fire trucks. Each individual panel connects to smart meters, which then optimize their output and direct electricity to street lights or back to the grid.

Roads are subjected to literally tons of abuse each day, so it's important for solar roadways to be durable. Otherwise, repair and maintenance costs could outweigh the benefits. What SolaRoad did was to design the roadway such that if one panel broke or was obscured by dirt, only that panel would be switched off.

SolaRoad isn't the only outfit that's hard at work. Scott and Julie Brusaw have proposed a wide-ranging plan for regular asphalt highways in the US to be replaced with solar-powered roadways. In fact, the government's listening. The Brusaws received their first government contract to work on the design in 2009, and have since taken to Indiegogo to crowdfund their latest experiment – a solar-powered parking lot outside their lab.

The panels can take loads of up to 125 tons, far higher than the Dutch bike path. The surface is also textured for improved traction, and comprises hexagonal panels that work better on curves and hills. They're even heated so they can melt snow and ice, and have built-in LEDs for road markings and messages.

If such panels were installed in regular parking lots, the couple thinks they could power the very stores they serve. The Internet has since gotten enthusiastically behind the campaign, helping it raise a total of US$2,258,811, over 220% of its original goal.





Harnessing the Breeze

Back in July, Denmark reported producing up to 140% of its electricity demand in just over a day. As a result, it was even able to export excess power to neighboring Norway, Germany and Sweden.

As one spokesman for the European Wind Energy Association aptly said, "It shows that a world powered 100% by renewable energy is no fantasy." Denmark has long been a strong proponent of wind energy, and it is well on track to meet its target of producing half of its energy from renewable sources by 2020 or earlier.

But not all countries have the luxury of so much open land like Denmark, which gets around three-quarters of its wind capacity from onshore wind farms. Fortunately, it seems like a Spanish company called Vortex Bladeless has thought of that. As the name suggests, they make wind turbines, minus the blades.

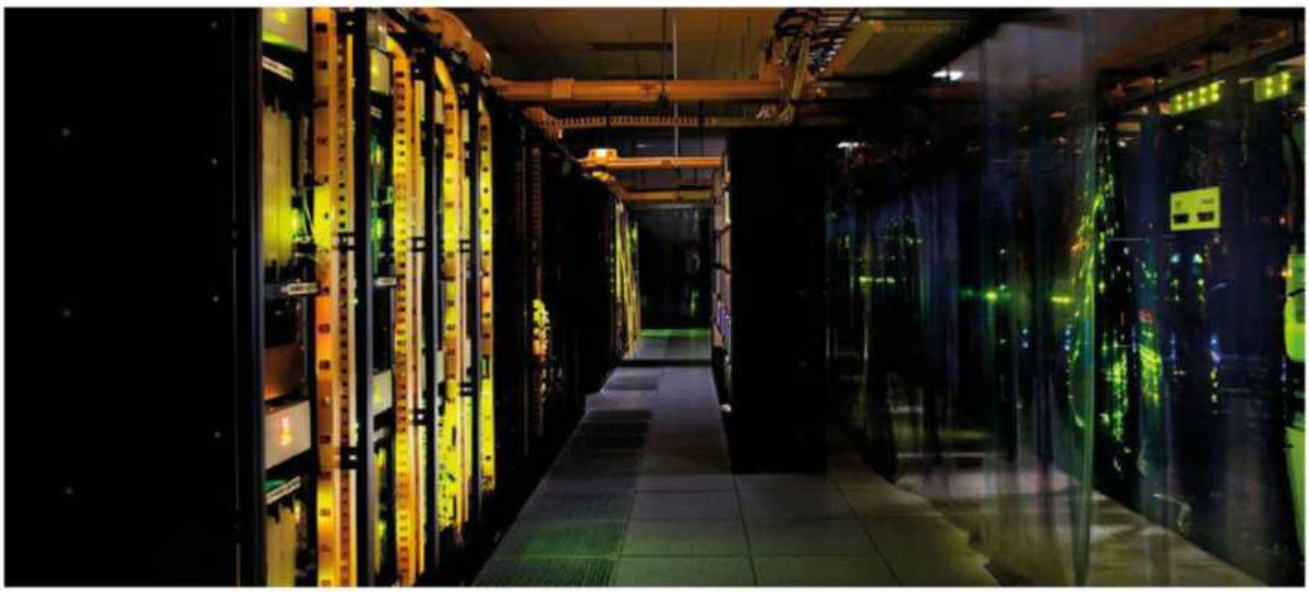
The new design helps save space, given that there are no huge rotating blades to consider. The company says you can double the number of turbines in the same space with its design, or – it stands to reason – put the same number of turbines in half the area.

There are additional advantages to the design, like an absence of mechanically moving parts. This means they are potentially cheaper to manufacture and maintain – Vortex Bladeless estimates an 80% reduction in maintenance costs – which could make it more palatable to cost-adverse governments.

Each thin, cone-like structure is made from carbon fiber and fiberglass composite, which allows it to vibrate in the wind as much as possible. These oscillations are what allow it to generate electricity. When the cone moves in one direction, two rings of repelling magnets at the base pull it in the other, and the kinetic energy is then converted to electricity.

It relies on an aerodynamic effect called vorticity, which produces a pattern of spinning vortices along structures. Vorticity can cause undesired oscillation in structures like bridges and compromise their integrity, but Vortex Bladeless will now harness and maximize these structural oscillations with its design.

PICTURES SOLAROAD, VORTEX BLADELESS



Data Pollutes

But before rushing to embrace technology as a harbinger of greener times, remember that there's always two sides to the coin. The rise of streaming media and the cloud means that service providers are constantly erecting new data centers or expanding existing ones to keep up with demand. Right here in Singapore, Equinix opened its SG3 data center in the first quarter of this year, the largest such center in Asia Pacific.

According to Greenpeace's latest Clicking Clean report, data centers are on track to become a significant source of electricity consumption in the IT sector. By 2017, they may comprise 21% of the sector's power use, more than even manufacturing's 16%.

Data center emissions are growing by at least 13% every year, and the entire IT sector is expected to comprise between seven and 12% of global electricity consumption by the end of 2017. This applies to other industries as well, and publishers are consuming more energy because of greater data center usage, even more than they did through printing presses.

In the US, many data centers belonging to the likes of Apple, Google and Facebook are located in North Carolina and Virginia, states which are heavily reliant on "dirty" energy like fossil fuels. Early this year, Amazon Web Services announced plans to build another data center in Virginia, while Microsoft announced similar expansion plans the year before.

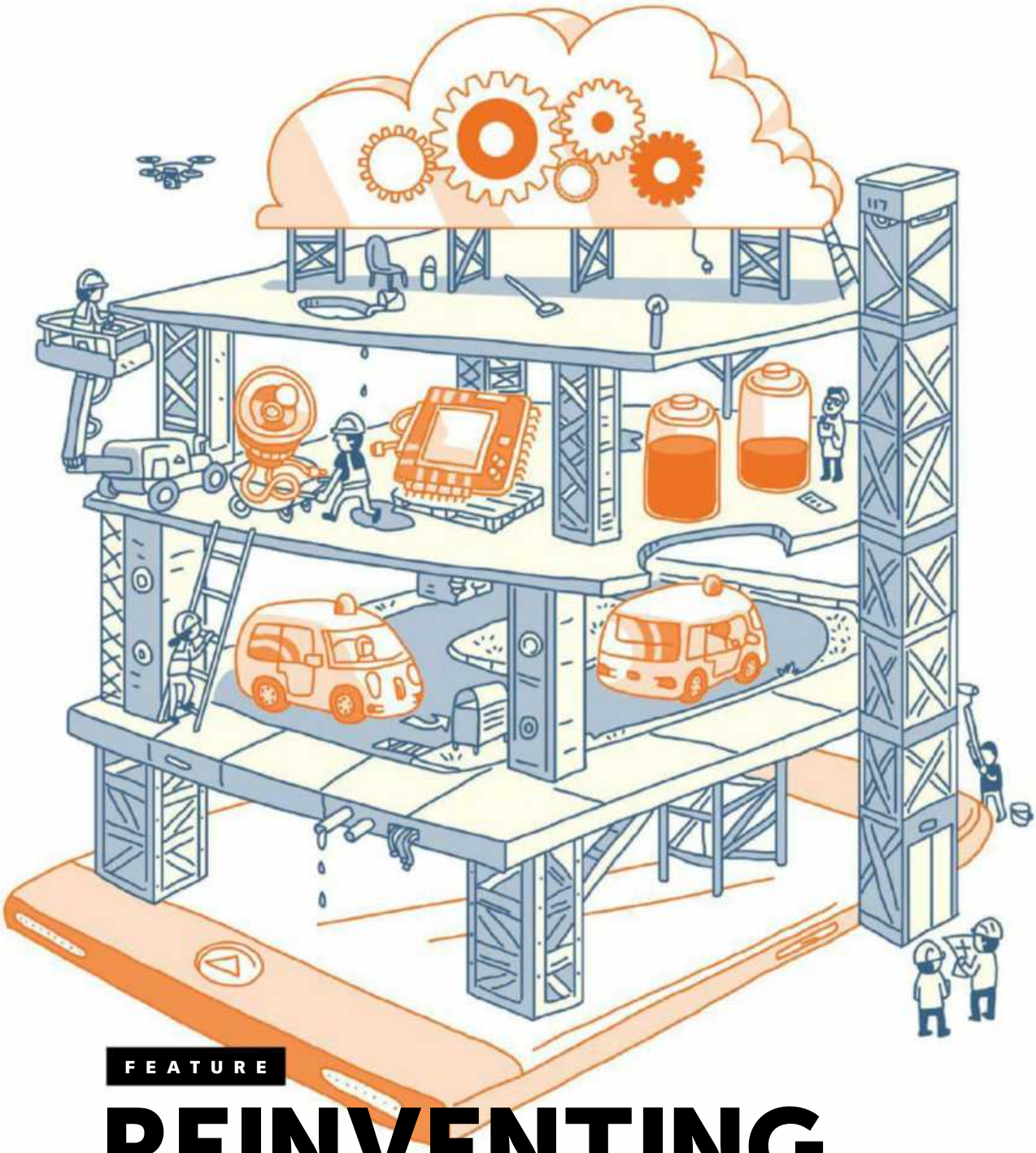
While most of these major players have committed to sourcing more of the power for their data center from renewable sources, energy utility monopolies in the two states pose significant barriers. Short of building solar farms like Apple has done, there is no clear path to renewable energy for data centers as a monopoly like Duke Energy generates only 2% of its energy from renewables.

A similar problem exists in Taiwan, where Google is set to significantly expand its data center operations. Renewables account for just 4% of the nationally-owned Taipower's generation mix, and just like energy monopolies in the US, customers like Google are not allowed to buy electricity from anyone else.

Put simply, technology isn't inherently good or bad. Things like the cloud have the potential to shape our lives for the better, but only if they're developed responsibly. The world's energy use will increase, and in order for technology to put its best foot forward, green technologies must get the attention and support they deserve.



PICTURES GOOGLE



FEATURE

REINVENTING FOR RELEVANCE

A glance at tech titans past and present.

Tech companies, old or new, need to stay relevant to the market forces that decide their fate and bottom lines. Sometimes it takes a drastic shift in business focus, others a little nudge in the right direction. No matter the choice, reinvention and refocusing aim for a simple purpose: to be considered an industry giant, either for the first time or once more.

Text by ***Liu Hongzuo*** Illustration ***www.skullbase.blogspot.com*** Art Direction ***Ian Chong***

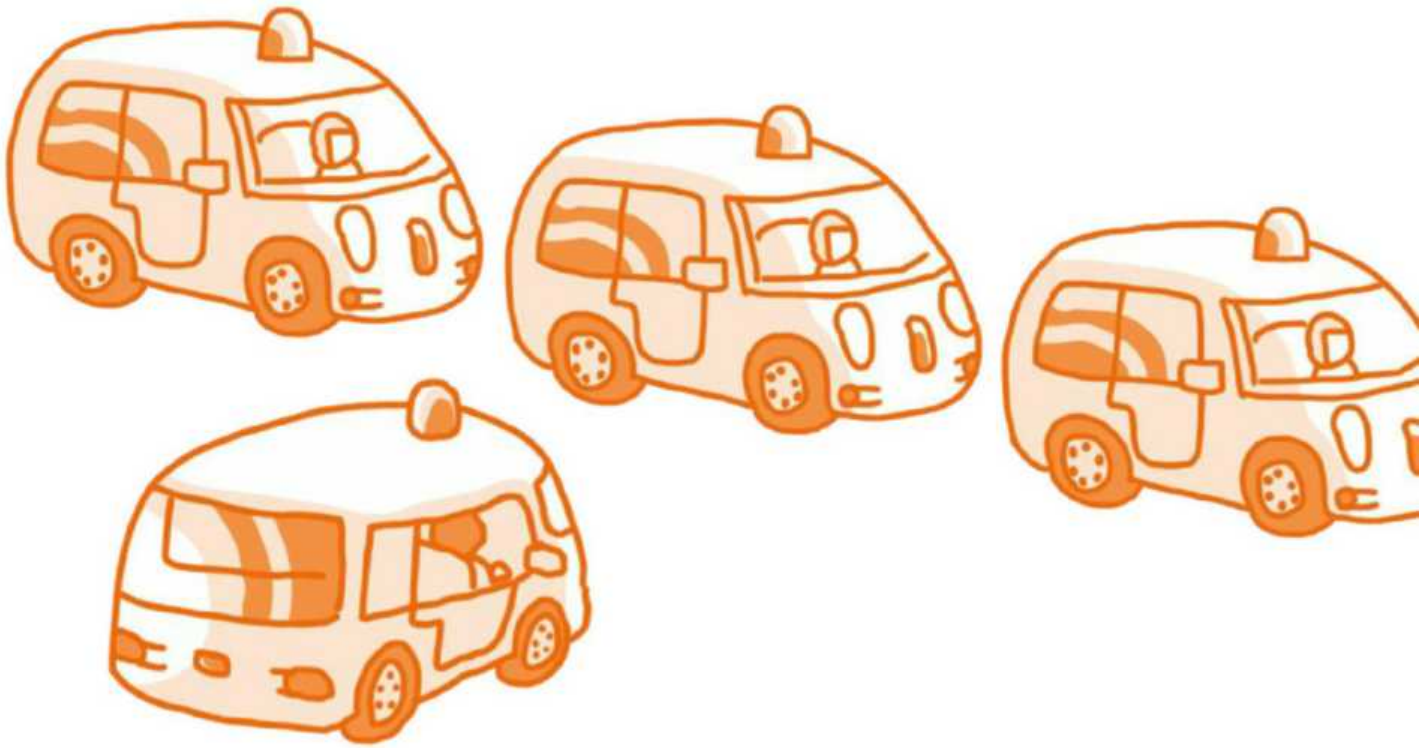
BLACKBERRY

Secure your data, play your cards right.

If we want to talk about businesses who constantly reinvent their approach in the technology industry, there's no need to look further than BlackBerry and their tenacity when it comes to moving from one lucrative industry to the next. While the common man may be familiar with the quagmire that revolved around their BlackBerry smartphone business - terminating 40% of their operating staff in late 2013, and going from 80 million active users around the globe in late 2012, to 33 million by June 2015 - most people would not realize that BlackBerry's decision is akin to knowing when to fold and go for the next hand.

BlackBerry's CEO, John Chen, is not shy when it comes to re-iterating the company's current focus. July 2015 saw another round of axing and reshuffling of BlackBerry employees (with numbers undisclosed), after Chen announced that they will limit smartphone production to the high-end market, and at most two phones annually. Chen, on the other hand, has also been eager to announce how BlackBerry has begun picking itself up through the cyber security industry. While it's not exactly fun and games, Chen was quoted saying that he believes "we are the No. 1 industry leader in not only having the vision, but also being able to execute (privacy protection and preventing data leakage and theft)" at the BlackBerry Security Summit held in New York in July this year.

Since last year, BlackBerry has been making a few notable buy-ins to increase their odds in the sector for providing security to small and medium businesses. In March 2015, BlackBerry had a working demonstration of what Secusmart was capable of. Secusmart, a German software-security maker BlackBerry acquired in December 2014 for its expertise in data and voice encryption (you heard that right). In a short four-months, BB unveiled the SecuTablet at the CeBIT conference in Germany. The final product was nothing short of BlackBerry showing off - the SecuTablet is actually a Samsung Galaxy Tab S 10.5, modified with IBM's 'app-wrapping' to distinguish between secured work apps and unsecured personal apps on the same tablet. For the cherry on top, data and voice encryption is secured with a physical Secusmart Security Card. And guess who is SecuTablet's target market? Huge conglomerates and governments who



"BLACKBERRY IS FAR FROM BEING DONE - TAKING EXISTING RESOURCES AND SLOWING DOWN THEIR SMARTPHONE BUSINESS ARM, TO REFOCUS ON THE SECURITY INDUSTRY."



need to keep spies, criminals and maybe even terrorists out of their data.

In April, BlackBerry also started acquiring WatchDox, a startup that makes software for cross-platform file security in the realm of digital rights management and secure file-sharing for enterprises. According to stock analysts, the WatchDox acquisition is an intelligent move, considering how cloud technologies and storage are preferred in many organizations as of late. BlackBerry's WatchDox encryption services will be able to provide a more robust layer of data-security, especially as it works across platforms.

Chen summarized his sentiment about BlackBerry's current focus in an April 2015 press release about WatchDox, "This acquisition represents another key step forward as we transition BlackBerry into the premier platform for secure mobile communications software and applications, supporting all devices and operating systems. Together with last year's Secusmart acquisition, Samsung partnership, our own internal development efforts, and now the acquisition of WatchDox, we now have capabilities to secure communications end-to-end from voice, text, messaging, data and now enterprise file-sync-and share."

To top it off, BlackBerry made a July announcement, saying that they will acquire AtHoc. For the uninitiated, AtHoc provides services for businesses to communicate and work together, even in times of crisis and emergency. BlackBerry believes that the acquisition of such a niche security service will bring in bigger clients for them - a thought that's not far-fetched, considering AtHoc's current list of clients already include the US Department of Defense, US Department of Homeland Security, and a range of public and private enterprise companies around the world dealing in health care provision and industrial sites. Their strategy, per acquisition announcement, is to incorporate their pride and joy - the BlackBerry Messenger - into AtHoc's existing alerts system. This deal is set to be concluded by November.

BlackBerry is far from being done - taking existing resources and slowing down their smartphone business arm, to refocus on the security industry, which BlackBerry predicts to be the next big thing in mobile technology. Chen said that he requires another 12 to 18 months to see any real traction in his new endeavor. We can only wait and see if it was worth the gamble.

NOKIA NETWORKS

Better, Faster, Stronger connectivity.

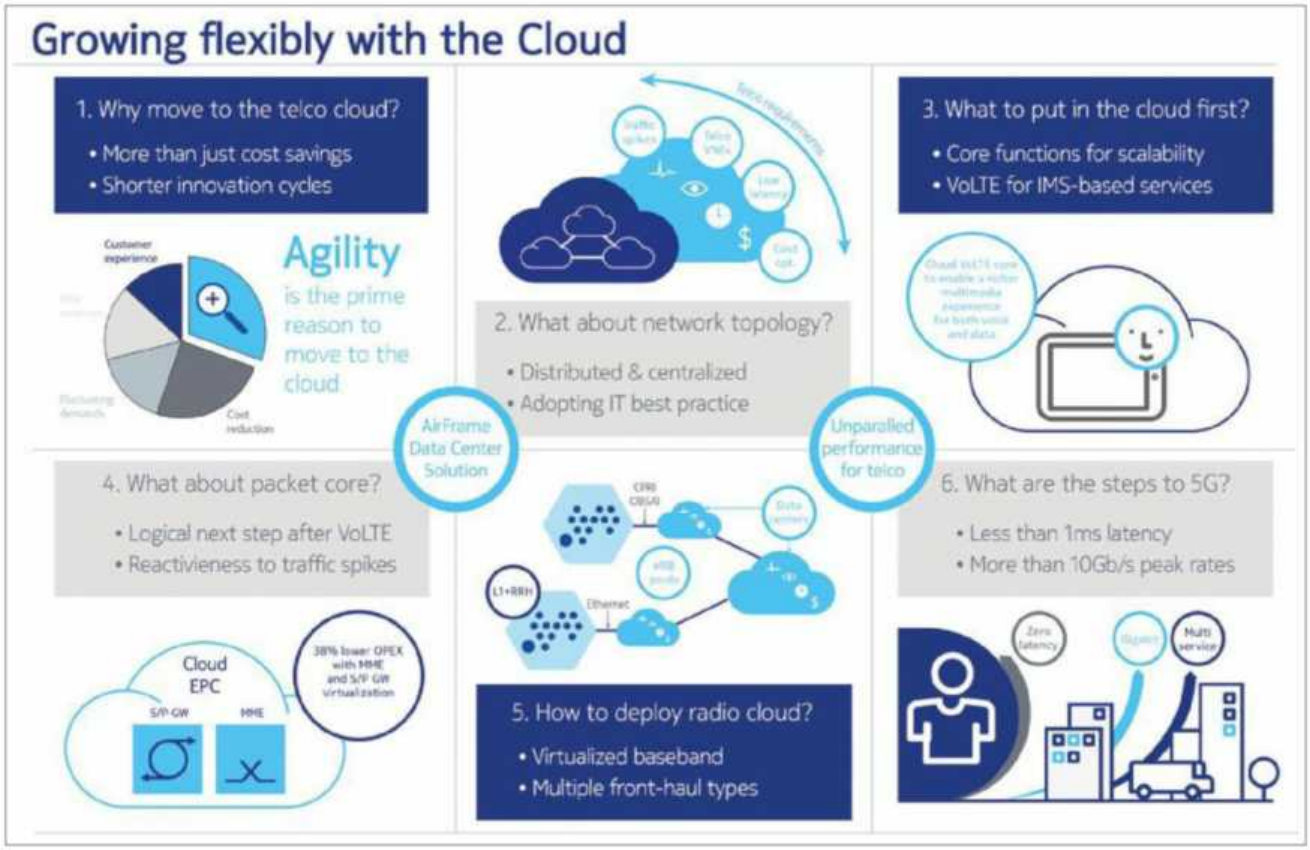
Times have been tough for Nokia. Even in their heyday, BlackBerry's handset market was focused around business users. Nokia on the other hand, were the undisputed heavyweight champion in the world in the consumer space before being forced to sell its whole Devices and Services division to Microsoft in late 2013. Less than two years later, even the Microsoft machine couldn't revive the Nokia hardware business, in turn writing off US$7.6 billion the Nokia deal and cutting thousands of jobs.

Nokia itself hasn't thrown in the towel yet however. Yes, Nokia is still in the business, being a 150-year-old Finnish company that initially started in unrelated industries such as wood-pulping and rubber before starting in early telecommunication - when the telegraph was the hottest thing around. Nokia is certainly versatile, and their sights are now set on the telecommunication business once again with Nokia Networks working on the Nokia AirFrame Data Center Solution.

If you're not privy to the telco business, simply think of it as coded messages travelling on a medium. If we compare smoke signals to the telegraph, it is easy to appreciate that telecommunication has vastly improved over centuries with the help of technology. Typical telco networks involve different end-points (called terminal nodes) being able to transmit correct messages to the correct recipients with the use of linkage and intermediate notes.

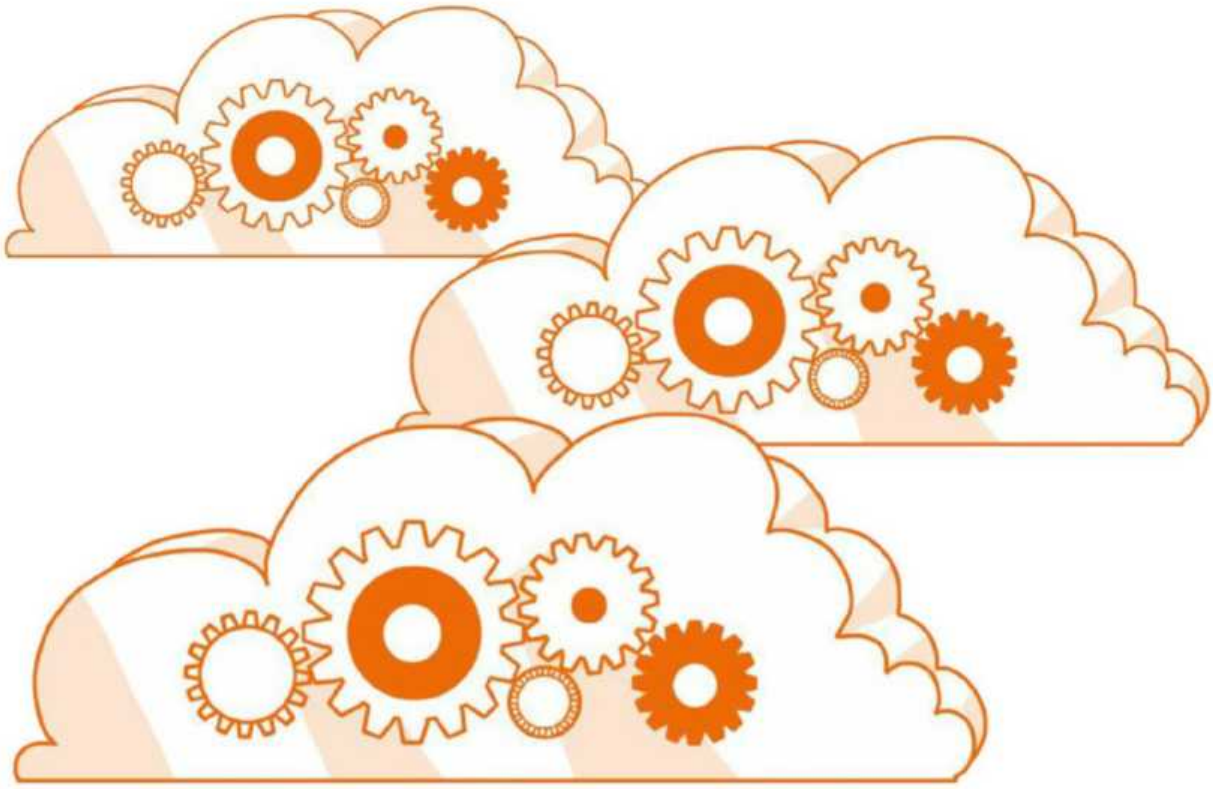
Fast forward to modern-day telecommunication, we now use fiber optics, communication satellites and many other forms of channels that can send huge amounts of data at unbelievable speeds. For cloud communication, it involves the use of internet infrastructure, providing servers for applications and services that need these servers to transmit voice and data. The components that use cloud - such as front-end platforms (essentially your mobile devices and more), back-end platforms (storage and servers that do all the heavy-lifting) and the Internet itself - are all treated as components of cloud computing architecture.

We had the opportunity to speak with Stan Fiala, Nokia Network's very own Head of Advanced Customer Solutions for Asia Pacific & Japan to understand just where the Nokia AirFrame Data Center Solution comes in. Naturally, when a telecommunication giant claims that they can "combine IT's best practice with existing cloud architecture to meet



Nokia purports that there are advantages to cloud communication, and it can result in using less hardware to achieve the same efficiency.

PICTURE **NOKIA**



connectivity demand", we'd ask how they do it. Fiala explained that the improvements cover key areas such as efficiency. One way is to make the infrastructure more powerful on the software side of things with constant innovation, so less hardware is needed to achieve the same efficiency (for hippies, this refers to reducing footprint; the technical term is Network Functions Virtualization). Nokia AirFrame does that by having the capacity to relocate radio from the field, to virtualized radio clouds in its strategically located data centers.

"The Nokia AirFrame Data Center solution is ready to support all Nokia NFVs, including Core, Operation Support Systems, Customer Experience Management, and the company's recently announced Radio Cloud Architecture," said Fiala. "Due to its open architecture it is also able to run 3rd party NFVs and support any IT cloud application."

This, in turn, means that Nokia's plans for the future of cloud telco will enable operators to implement their footprint-reducing, data-demanding NFV strategy, but also expand into new business models, such as renting data center capacity for customers' IT applications.

Besides having the readiness to efficiently support 5G networks, Nokia Network feels that they need to tackle security issues in the cloud architecture.

"To address this, Nokia has opened the Nokia Security Center in Berlin which provides a platform for security research and enhancing further Nokia's cooperation with mobile network operators, partners, governments and universities to develop and share security know-how and expertise," shared Fiala.

And to appeal to operators that come on board their AirFrame, Nokia has Mobile Guard, which was showcased at Mobile World Congress 2015. Mobile Guard is a detection system that can even suss out and prevent malware transmission based on data patterns.

"It monitors the mobile broadband traffic, detecting malware or abnormal Internet of Things (IoT) device behavior via device profiling and takes actions such as shutting down the device via configuration server, enforcing the expected traffic profile, or triggering remote update of the firmware."

In essence, Nokia knows the market wants (practical efficient and future-ready cloud architecture) and what it needs (security) and has combined both requirements into one fluid movement for their network business. That's not to say rivals like IBM or Huawei - whom both have cloud telco businesses too - are less efficient, but it takes foresight, experience, knowing the market, to re-invent in their core business in ways unheard of.

Nokia is prepared for a bigger pool of operators demanding reliable and faster data connection, while its rivals are soliciting clients based on current cloud architecture. This gives Nokia the lead-time to get back into the game. Their game.



XIAOMI

Mi-ting current and future demands.

Imagine the following. You start a smartphone-centric company in 2010, with a simple modus operandi. Four years roll by, and you've sold 60 million units. Every technology news outlet and rumor site hails your company as the new Apple. What was once an unheard startup milling amongst tech giants have suddenly become the 5th largest smartphone maker with a valuation of US$45 billion (S$61.5 billion) in 2014. As of Q2 2015, market intelligence body, International Data Corporation (IDC), currently lists Xiaomi as the 4th largest with a 5.3% smartphone market share. In comparison, it took BlackBerry a good 19 years to go from start-up to earning a place in the NASDAQ-100 Index.

For many, this type of performance is just a dream. For Xiaomi, it's their reality. The question now is how do you stay on top?

Being a late entrant to an over-saturated smartphone market, Xiaomi's options were clear: they are to blow competition out of the water with phones that matched high-powered hardware that Samsung offers, the ease-of-use of which iPhones are known for, plus a little bit of magic in the form of marketing and cost-cutting.

The Chinese phone maker is led by none other than Lei Jun - a billionaire valued at US$13.4 billion (S$.18.3 billion) and currently ranked 87th in Forbes's list of successful billionaires (he's ranked 6th, if we are looking at China alone). Lei Jun has vast experience as a businessperson, having acted as CEO for a near-bankrupt software company, Kingsoft, and struggled with inventory problems during his short Vancl (an online apparel and household goods retailer) stint. Both experiences are directly related to Xiaomi's current stratagem - avoiding a mature section of the market, and streamlining supply to match demand.

Xiaomi's strategy is an elegant example of playing natural advantages into market demands. The natural advantage refers to how Chinese entrepreneurs have a knack for reverse engineering and imitation. In fact, it's written in the Handbook of East Asian Entrepreneurship (by economic and entrepreneurship professors Tony Fu-Lai Yu and Ho-Don Yan, no less) that most entrepreneurs in China learn by imitation, and reverse engineering is a lucrative option, especially when coming into mature markets.

By application, to dominate the smartphone scene, Xiaomi does not need to be a first-mover, since Apple and Samsung are doing all the heavy-lifting for smartphone innovation.

Instead, Xiaomi needed to meet the late-mover demand - an educated market seeking affordable smartphones that don't suck. Simply find out what the newest Apple or Samsung phone can achieve, learn the essentials that make the latest features possible, follow feedback for other phone interfaces to improve their own, tap into the local manufacturing strength for affordable parts, and finally cut out the middleman by appealing directly to fans. Xiaomi phones are half the price of a rival flagship product, with all the important flagship parts intact.

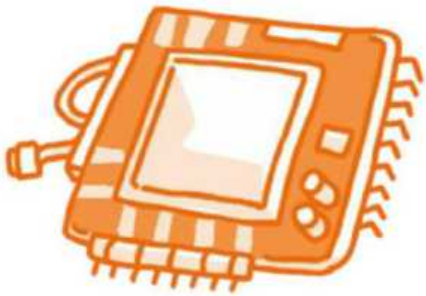
Of course, we're not forgetting how clever the flash-sale tactic is when it comes to creating consumer demand. And yet, the flash sale tactic isn't exactly an ideal method for the young Chinese smartphone maker eager to expand globally.

Specifically, Xiaomi was already having trouble with the Indian market - despite selling more than 500,000 smartphones in the span of five months since its July 2014 Indian debut. Xiaomi had to conduct urgent delivery runs by flight (instead of relying solely on scheduled cargo flights) to India in order to cope with demand - and it barely alleviated buyer frustration. Xiaomi also had to rope in Foxconn Technology Group - iPhone's manufacturer - to increase production, as their then-slew of manufacturers (which included Foxconn International Holdings, the non-iPhone making Foxconners) was insufficient to handle demand.

Instead of aggressively expanding to ten other new markets initially planned, Xiaomi had to cut down to five markets for now, putting Brazil, Russia, Thailand, Mexico, and Turkey on the 2015 pipeline. Hugo Barra also confirmed that breaking into the US market is "no less than a year-plus away", in a July 2015 Bloomberg video interview.

The temporary cessation of Xiaomi's Indian sales in late 2014 due to a patent infringement tussle with Ericsson dampened further growth plans. Tempered by experience, Xiaomi is a lot more cautious today, doing patent homework diligently for their eventual US breakthrough.

Xiaomi's current successes and struggles are a clear example of what it really takes to understand and appreciate the complex market, making the most out of the situation by addressing flaws in an honest, no-frills manner while playing to strengths. Indeed, Xiaomi is finding out that it takes more than just being cheap and good. HWM





FEATURE

CONQUERING SPACE THROUGH PRIVATE ENTERPRISE

The space race of the 1960s is long over. But while it's no longer as popular for governments to reserve significant chunks of their budgets for space programs, private enterprises are stepping up to fill the void. Indeed, such is the goal of the Google Lunar XPrize, a competition hosted to kickstart a new and more collaborative space race.

Text by ***Koh Wanzi***
Illustration by ***Ziyue Chen***
Art Direction by ***Ken Koh***



A NEW ERA

Private enterprises and individuals could drive a new era of friendly competition and cooperation in space technology.

As a lone blue marble suspended in a void powdered by stars, Earth cuts both an immeasurably beautiful and lonely figure. For all of our technological advancement, space continues to dazzle and inspire us, constrained as we are by our gravity-bound perspective.

Space should also unite us and remind us of our common humanity, so it's ironic that one of our key milestones as a species – putting a man on the Moon – was driven by a space race between two hostile world powers.

US government spending and the geopolitical situation of the time powered the Apollo missions. The space race of the 1960s saw NASA receive its highest ever budget, at 4.5% of the US federal budget. However, as Cold War tensions died down, government support for space missions dwindled.

Even though we continue to probe the depths of space – New Horizons recently returned long-awaited images of Pluto – much of the political capital to pool resources into space missions has waned, and it seems a poor choice to rely entirely on government-sponsored research to advance our reach into space.

Privatization is the way forward, which is what the Google Lunar XPrize is aiming for. Space doesn't have to be seen as the sole prerogative of big government budgets, and private individuals and enterprises can hop aboard to make these moonshots a reality.

We've rounded up a handful of teams for a closer look at their efforts to land a rover on the Moon, and the possible implications of their long-term visions.

• • •

Part-Time Scientists

This 70-strong team based out of Germany recently teamed up with Audi to incorporate the latter's Quattro four-wheel drive technology in a Moon rover. The Quattro four-wheel drive technology is found in cars like the Audi S8, and serves as a prime example of private enterprises – even those that appear far removed from space exploration – getting onboard with the development of space exploration technology.

The Audi Lunar Quattro, as it is named, will be powered by a lithium-ion battery pack that is supplemented by energy collected by its 30cm^2 solar panel. The Moon has no atmosphere, which means that there will be no clouds to block out sunlight and temperatures can rise to over a 100°C. On the bright side of the Moon at least, there should be an abundance of energy for this moon rover.

Each wheel has a dedicated electric motor for all-wheel drive traction to help it better traverse the rocky lunar surface. Its top speed is a stately 3.6km/h, roughly the pace of a leisurely walk.

Double wishbone suspensions are used for all four wheels, each of which can be rotated a full 360°. This type of suspension provides engineers more freedom to work with. For instance, they're able to work out the effect of moving each joint, so the suspension and wheel motion can be optimized. It is also easier to determine the loads that different parts will be subject to, thus allowing more lightweight parts to be incorporated.

These are all arguably valuable advantages to have in a Moon rover. On foreign terrain like the Moon, you want a nimble rover that has been tuned to overcome obstacles and navigate reliably. Furthermore, weight savings are key in space transportation, where every gram shaved off can translate into savings in both fuel requirements and launch vehicle costs.

Two cameras are mounted to a moving head at the rover's front, capable of capturing detailed, stereoscopic images and sending them back to Earth. A third camera is directed at the ground, used to study lunar materials and take high-definition images.

The Lunar Quattro is constructed primarily with high-strength aluminum, and it tips the scales at around 35kg. However, there are plans to reduce the weight of the final design with the use of magnesium and other design modifications.



PRIVATIZATION IS THE WAY FORWARD, WHICH IS WHAT THE GOOGLE LUNAR XPRIZE IS AIMING FOR.

Google Lunar XPrize

The XPrize Foundation is a non-profit organization that wants to serve as a catalyst for change and innovation. It believes that competition and incentives are what drive innovation and progress. To that end, it holds public competitions to give entrepreneurs and inventors the platform and motivation they need to pull out all the stops.

The Google Lunar XPrize has a fairly audacious goal – creating a new era of affordable access to the Moon and beyond. Beginning in 2007, the Lunar XPrize attracted 29 teams from 16 countries to compete for its US$30 million prize purse. Today, just 16 teams remain, with until the end of 2016 to secure their goal of landing a rover on the Moon, travel 500m, and transmit high-definition video and images back.

FOR THE GOOGLE LUNAR XPRIZE, ASTROBOTIC HAS DEVELOPED GRIFFIN, A LARGE-ISH MOON LANDER ABOUT 1.6M TALL AND 4.5M WIDE.



The Eighth Continent

The Moon is often romanticized as the eighth continent. As Earth's closest neighbor, the Moon has been held up as a potential goldmine for resources like rare earth and platinum-group elements. The uses of these elements span a wide gamut, ranging from TV sets and cancer treatments to catalysts in manufacturing processes.

The Moon is the new Africa, an entirely new Dark Continent – mysterious, uncharted, and nearly unmarked territory up for the grabs. But this time, the contenders aren't European colonizers, but the entire human race.

Astrobotic

Astrobotic has a lofty goal – the democratization of Moon landings. As a lunar logistics company that aims to allow individuals, organizations, and countries to deliver payloads or packages to the Moon, Astrobotic wants to make lunar deliveries more accessible.

For the Google Lunar XPrize, Astrobotic has developed Griffin, a large-ish Moon lander about 1.6m tall and 4.5m wide. Given its lunar delivery goals, it's no surprise that Griffin is equipped with flexible payload mounts for a variety of cargo.

The lander is tricked out with its own smaller, surface rover (called Andy), but it can be adapted to carry other payloads to support robotic missions like surface sampling, regional prospecting, and skylight (holes in the Moon's surface) exploration. Griffin is a fully automated lander, relying on software to parse data from onboard cameras, an inertial measurement unit (IMU), and laser-based remote sensing technology (LIDAR) to ensure smooth and accurate landings.

Its onboard avionics systems are rugged and radiation-tolerant and can land the craft within 100m of any targeted landing site. On approach to the Moon, the Astrobotic Autolanding System compares images from the lander's cameras with high-resolution NASA lunar surface images to determine the craft's position and altitude. As it nears the surface, LIDAR is used to construct a 3D model of the surface of the landing zone and help it avoid hazards like slopes and rocks.

Griffin's main frame is constructed of aluminum, and its profile from the front vaguely resembles a giant spider. Its four legs absorb the shock of touchdown and help stabilize the lander.

In addition, it is equipped with an isogrid (a metal sheet with a triangular grid pattern) deck which can accommodate payloads both above and below it. Griffin is further outfitted with a frustrum ring at the top and radial stiffeners at the bottom for other types of cargo like satellites.

To give you an idea of what lunar logistics services to the masses might look like, Astrobotic is hosting an interactive mission design worksheet on its website that lets you indicate things like your payload type, destination (lunar orbit or landing?), and if you intend to deploy it to the surface. In fact, it's also running a program called MoonMail, that lets people send various mementos to the Moon onboard Griffin.

• • •

Hakuto

Hakuto will deploy a unique, dual rover system to explore the lunar surface. Scientists have speculated in recent years that the lunar surface may actually host underground caves and tubes similar to those found in volcanic areas on Earth, and Hakuto wants to use its rovers to access these areas.

As private enterprises turn their gaze toward the stars and lunar exploration, a lunar base could eventually prove invaluable. However, such a base would need to be shielded from the radiation, micrometeorites, and extreme temperatures that pummel the surface. These underground geological features could serve as prime locations for future lunar bases, which is why Hakuto is so keen on exploring them.

Moonraker, Hakuto's larger four-wheel rover, will be tethered to a smaller two-wheel rover called Tetris that weighs just 2kg. At just 270mm x 540mm x 210mm, Tetris can be easily lowered down into narrow tubes by Moonraker.

Moonraker itself is fairly compact, measuring just 480mm x 600mm x 540mm and weighing only 8kg. These diminutive envoys to the Moon thus exemplify the strengths of Japanese engineering – the miniaturization of complex machines and tight integration of electronics.
Moonraker and Tetris are constructed using strong, lightweight, autoclave-molded carbon fiber reinforced plastic materials, most commonly found in aircrafts and rockets. Both rovers are built to withstand the harsh lunar temperatures, which can range from -150°C to over 100°C. The wheels are also made using a thermal insulation material to insulate the rovers' bodies from the thermal fluctuations of the lunar surface.

In addition, because the Moon's surface is covered with extremely fine and abrasive sand called regolith, the wheels are also rugged enough to handle the soft and treacherous terrain. Multiple fin-like structures appear designed to dig deep into the regolith for better traction.

A hyperbolic mirror camera system on Moonraker allows it to capture 360° images. Images and data from other sensors will be used in Simultaneous Localization and Mapping (SLAM) to make sense of its surroundings and estimate its location. SLAM is used expressly for constructing a map of an unknown environment. It is designed to work on incomplete information and achieve operational success rather than a perfect picture, which makes it suitable for lunar landings.

Hakuto's rovers will actually be hitching a ride on Astrobotic's Griffin lander to the Moon. Not only does this demonstrate Griffin's ability assist in future robotic missions, it also allows Hakuto to focus entirely on rover development.



Omega Envoy

Backed by the non-profit Earthrise Space Foundation, Omega Envoy aims to create a viable commercial lunar delivery service for a future space transportation industry. It's named its rover Sagan, after the renowned astrophysicist and researcher.

Sagan also looks a lot like the endearing trash-collecting robot Wall-E in Pixar's animated film, with a similar head that houses two large lenses. But don't let its adorable looks fool you. The rover packs some advanced technology and recently completed successful mobility and visual tests at NASA's Lunar Regolith Bin, the largest indoor simulation of the lunar surface.

Because of the charged particles in solar wind, lunar soil is very dusty and sticky. The fine particles are also jagged, which means they can scratch spacesuits, face shields, and camera lenses. This is a problem for rovers, which need to maintain clear, unsullied lenses in order to transmit clear images back to Earth.

To that end, Sagan will be using an EDS (Electrodynamic Dust Shield) to keep dust away from Sagan's cameras. The shield itself is a transparent indium tin oxide painted on glass. EDS technology is able to lift and transport soil particles by applying dielectrophoretic forces to them. By printing a basic pattern on materials – in this case the indium tin oxide – researchers can send out high voltage signals to generate a non-uniform electric field to control the direction of the soil.

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All in the spirit of competition

Competition between the US and the Soviet Union propelled an era of technological progress in the space race, and maybe competition – of the friendlier sort this time – can help spark off a new space age.

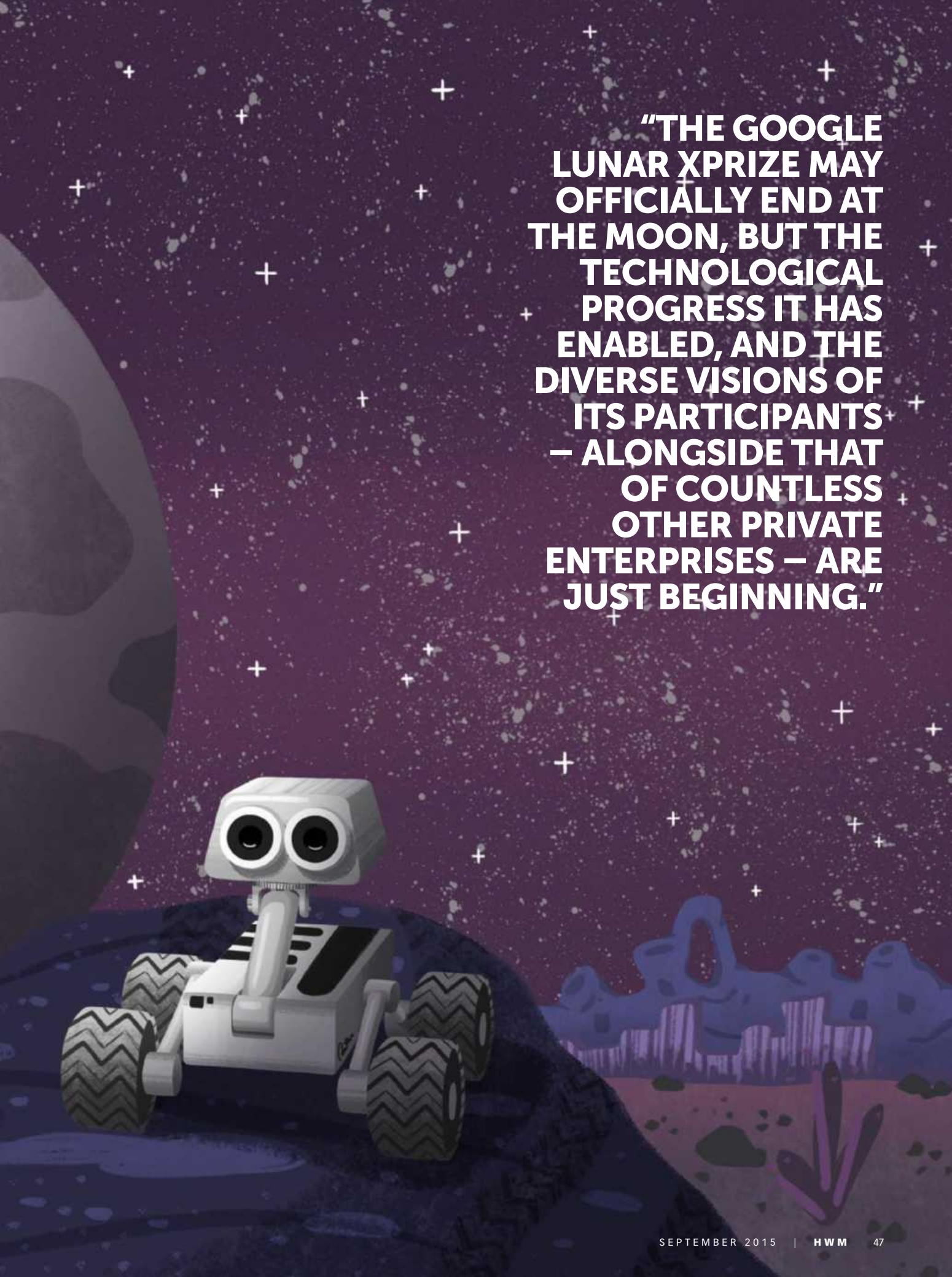
Audi's collaboration with Part-time Scientists on the Audi Lunar Quattro shows that even terrestrial technologies can have applications in space. And once these technologies have been adapted for and proven in space, it stands to reason that they could be used in extreme environments back on Earth for applications like disaster rescue and scientific research.

Astrobotic and Hakuto's partnership also illuminates a probable way forward for private enterprises looking to make their mark in space. While the space race of the 1960s saw each nation guarding their technology fiercely, the 21st-century version of the space race could see private companies with varying strengths and interests combine their expertise to achieve their goals.

The company behind Hakuto, ispace technologies, envisions space as simply new territory for humans to explore, gather resources, and eventually settle. Its partnership with Astrobotic thus lets it focus on developing the right technology to achieve its goals. In turn, Astrobotic is working with fellow NASA contractor and space transportation company SpaceX to launch its Griffin lander into space on the latter's Falcon 9 rocket.

On the other hand, the Earthrise Space Foundation, which backs Omega Envoy, has set its sights on providing private companies, government agencies, and other institutions with affordable resources to undertake space exploration. Astrobotic itself goes a step further by aiming to bring a semblance of access to the Moon down to the level of the everyday man.

Again, we're reminded of how things have changed from the time when only rich governments had the resources to take on space. The Google Lunar XPrize may officially end at the Moon, but the technological progress it has enabled, and the diverse visions of its participants – alongside that of countless other private enterprises – are just beginning.
When Griffin's Andy and Hakuto's Moonraker and Tetris rovers reach the moon, they intend to engage in a friendly race to the finish line. They may be competitors, but regardless of who prevails, it will be another small step forward for mankind. HWM



"THE GOOGLE LUNAR XPRIZE MAY OFFICIALLY END AT THE MOON, BUT THE TECHNOLOGICAL PROGRESS IT HAS ENABLED, AND THE DIVERSE VISIONS OF ITS PARTICIPANTS – ALONGSIDE THAT OF COUNTLESS OTHER PRIVATE ENTERPRISES – ARE JUST BEGINNING."

HIGH-TECH SHUTTERBUG

by *Koh Wanzi*

They say a picture speaks a thousand words, and so too, perhaps, does a photograph. These gadgets won't just help you capture those fleeting moments as they happen, but break free from the limitations of traditional cameras to ensure you'll have vivid images and video to remember things by.



HEXO+

WWW.HEXOPLUS.COM

For all of your ability to capture sweeping panoramas, you're still very much restricted by your earthbound perspective. Hexo+ is a flying autonomous camera that allows you to defy gravity – in proxy – with automatic tracking you so you're always framed within every shot. Simply choose the right capture angle from your phone and enjoy breathtaking, hands-free photography from dramatic heights. Hexo+ comes with six motors, a titled frame, and an aerodynamic shell to help withstand winds of up to 24km/h. It's meant to be paired with a GoPro though, which unfortunately, isn't included.



DXO ONE

WWW.DXO.COM/US

Your iPhone has a great camera, but it's no DSLR. But with the DxO One, it can be. The three-inch shooter attaches to your iPhone via a Lightning connector and allows it to capture DSLR-like image quality with its 1-inch sensor and F1.8 aperture. It doesn't need an iPhone to work, but the iOS companion app adds intuitive controls over things like aperture, shutter speed, and ISO. And for all the photography buffs out there, you'll be pleased to know that the DxO One lets you shoot wonderfully detailed images in RAW as well.



SPHERICAM

WWW.SPHERICAM.COM

The Oculus Rift is due for an early 2016 release, and now you have a camera that lets you record video for playback on a VR headset like the Rift. Sphericam is a sphere-shaped, 360º video camera that can record 4K video at 60fps. It begins recording at the push of a button and videos can be viewed on a tablet or laptop as well. Video is captured by six cameras located around the 65mm-wide device, and white balance, exposure and other settings are automatically synced across all the cameras.

PICTURE 123RF / STOKKETE



PODO

WWW.PODOLABS.COM

Podo is a tiny camera that sticks to any surface – walls, street lamps and railings do just fine – allowing you to simply hop into the frame. It's also Bluetooth-compatible, which means you can pair it with your phone to preview photos, snap a picture and transfer it instantly to your phone. It sports an 8MP sensor that can also record up to two hours of 720p30 video. Truly, it is the bane of all selfie sticks – you'll never need one of those silly things again.

SONY RX100 IV

WWW.SONY.NET

The Sony RX100 IV pocket camera packs a new 1.0-inch stacked Exmor RS CMOS sensor with built-in DRAM memory. It offers professional features like high-frame rate shooting and 4K video recording in an exceedingly compact package. Fast-moving objects are also no problem with its 40x super-slow motion video capture capabilities and a 1/32,000 shutter speed that lets you capture the world the way you want to. Finally, it pairs a Zeiss Vario-Sonnar F1.8-F2.8 lens with an autofocus system that allows you to pick out a moving subject in a split second.

Sign up now and receive a FREE tyre inspection service at the event!

Breakfast with *torque*

DATE: Sep 26, 2015 (Saturday) **TIME:** 9am – 12pm (registration starts at 8.30am. Breakfast will be served.)

VENUE: Portico Singapore, 991B Alexandra Road, #01-10, Singapore 119970

REGISTRATION FEE: $15 per person or $25 for 2 persons · Free goodie bag worth $40 for every participant

Planning a long road trip to our neighbouring country soon? The dates are blocked, your friends are ready and the car is raring to go. But have you checked your tires' condition?

Breakfast with *Torque* this September brings you Bridgestone, the award-winning tyre brand that focuses on quality and the safety of you and your family.

Every year, Bridgestone invests more than $800 million in the research and development of its tyres. With thousands of hours of testing and refining these tyres using cutting-edge technology, it continues to surpass global safety standards, winning accredited awards like "Most Trusted Tyre Brand" in both Australia and New Zealand, in an independent survey in *Reader's Digest*.

The **Bridgestone Potenza Adrenalin RE003** has raised the bar even higher on cutting-edge performance. With its unique tread pattern and tyre composition, it delivers an incredibly stable driving experience for car drivers.

Join us to find out how Bridgestone blends safety and style in the Potenza Adrenalin RE003.

REGISTRATION CLOSING DATE: Sep 13, 2015*

*Limited to 40 readers. Should there be an overwhelming response, the 40 will be picked via a lucky draw. Successful registrants will be contacted via phone or e-mail by Sep 18, 2015. Payment will be processed only if your registration is successful (payment must be made via Visa or Mastercard).

BRIDGESTONE
Your Journey, Our Passion





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TEST

LAB RESULTS

Every month behind the doors of our super secret gadget testing facility, the latest tech products are put through their paces using industry recognized benchmarks and our own blend of real world usage scenarios. Here are our findings.

MORE INSIDE>

NIKON D7200
Giving the flagship DX something to shout about.

JAWBONE UP3
The one that works better when you're asleep.

PIONEER AVH-X8750BT
Getting Apple CarPlay into your car.



HOW WE RATE:
Products are rated on a scale of **1** to **10**; **1** being so abysmal, it should be a crime to sell it, and **10** being almost perfect. Come now, nothing is perfect. An Editor's Choice may also be awarded based on unique merits.

TEST BEST PERFORMANCE HWM SINGAPORE

TEST BEST VALUE HWM SINGAPORE

TEST EDITOR'S CHOICE HWM SINGAPORE

DOING IT ALL ON THE CHEAP

Multi-function printers are all the rage for the very simple reason that one device handles all your document needs. And thanks to maturing technologies, what used to be premium features like integrated Wi-Fi can be found on the most basic of models. Here are three extremely affordable AiOs for the modest home or office.

Text by *Ng Chong Seng*
Photography by *Jasper Yu + Vernon Wong*
Art Direction by *Ian Chong*




To Do:
Test Page
VS
CANON PIXMA MG2570S
•
EPSON EXPRESSION
HOME XP-225
•
HP DESKJET 3630

CANON PIXMA MG2570S

Simply put, the new Pixma MG2570S is the cheaper version of the already very affordable MG2570, the latter of which costs just $69. The S in MG2570S actually refers to the new PG-745S and CL-746S ink cartridges that the printer comes bundled with, which hold lesser ink than the regular PG-745 and CL-746. With that, Canon is able to knock a further $10 off the price, which means the MG2570S costs a mere $59. Fortunately, if you print frequently, the regular PG-745/CL-746 and even higher volume PG-745XL/ CL-746XL cartridges can still be bought and used with the MG2570S.

Sporting a maximum print resolution of 4,800 x 600 dpi, the MG2570S touts ISO print speeds of 8ipm for mono and 4ipm for color documents. But the MG2570S isn't just a printer; it's a copier and scanner too. We also like that its scanner lid is adjustable to fit thicker books and magazines. At this price, we don't expect to find an LCD control panel; and indeed, there isn't one.

Incredible price. Good print quality.

Low volume ink cartridges. No built-in Wi-Fi.

The printer is as basic as it comes though and is only equipped with a USB 2.0 port for connectivity. It is however, able to switch on itself automatically when it detects a print command. There's even a Quiet Mode function that you can activate from the printer driver utility to reduce engine noise. Software-wise, you can use Canon's My Image Garden to easily create appealing collages and calendars using photos you've on your PC.



AT A GLANCE

No. of Cartridges
2

Print Resolution
4,800 x 600 dpi

Print Speed
8ipm (black), 4ipm (color)

Weight
3.5kg

Price
$59



Walk-up jobs aren't a problem despite the lack of an LCD panel, because the buttons are pretty self explanatory.



Without wireless support, the only way to use the MG2570S is to hook it up to your PC with a USB cable.



The MG2570S comes with a pair of new, low-cost ink cartridges, which are sufficient for occasional printing.

EPSON EXPRESSION HOME XP-225

One of the top brands consumers look out for when buying a printer, Epson actually doesn't have an inkjet all-in-one under the sub-$100 category. If you're on a tight budget and will only buy from Epson, there's the Expression Home XP-225 that goes for $128.

One of the smallest AIO color inkjet printers around, the XP-225 expectedly comes with additional features that its lower-priced peers lack. For example, in addition to USB connectivity, it also supports Wi-Fi. This enables it to do things like print from and scan directly to a mobile device or print to any email print-enabled Epson printer from any devices or PCs with email access. There's also an Epson Creative Print mobile app that lets you print photos from your Facebook account or use your photos to generate and print coloring book projects.

Low print cost per page. Wi-Fi. High resolution print and scan.

Doesn't print that fast despite being more expensive.

While the XP-225 is more expensive than both the other two printers in this roundup, it's print speeds aren't faster. Based on the ISO standard, the XP-225 has a print speed of 6.2ipm in black-and-white, and 3.1ipm in color. But it supports a higher print resolution, topping out at 5,760 x 1,440 dpi. And some of the money also goes to its CIS-type flatbed scanner that sports a higher optical resolution of 1,200 x 2,400 dpi. We'll see if we do get better results in the next few pages.



AT A GLANCE

No. of Cartridges
4

Print Resolution
5,760 x 1,440 dpi

Print Speed
6.2ipm (black), 3.1ipm (color)

Weight
3.9kg

Price
$128



Control buttons are found at the front of the printer, but still no LCD screen controls.



The XP-225 supports two types of interface: USB and Wi-Fi.



We like individual ink cartridges for more control over ink usage.

HP DESKJET 3630

When we first heard that the DeskJet 3630 costs just $79, we thought it would be a pared-down, no-frills printer. Surprisingly, not only is this an all-in-one device that sports print, copy and scan features, it also supports wireless connectivity. Along with the HP Printer Remote mobile app, this means you can manage print tasks from your smartphone or tablet conveniently or even scan on the go. Apple's AirPrint protocol is also supported.

Shaped like a bowl versus the typical box form factor, the DeskJet 3630 is undoubtedly the nicest looking of the trio we're testing here. In fact, the white-and-blue device looks good enough that we don't mind putting it in the bedroom. If you're worried about noise, there's a quiet mode you can engage to keep noise to a minimum. There's also an auto-off feature to cut down on energy cost.

Striking design. Even manages to cram in a small status LCD.

Heavy. Tri-color cartridge not the most economical.

On paper, the DeskJet 3630 seems to be a fast printer (for its class). HP lists an ISO print speed of 8.5ppm (HP's ISO PPM is equivalent to ISO IPM) for mono and 6ppm for color. And at the best color setting and using suitable media such as photo paper, it's capable of 4,800 x 1,200 optimized dpi. Consistent with most AIOs, its flatbed scanner uses a contact image sensor, and sports an optical resolution of 1,200 dpi.



AT A GLANCE

No. of Cartridges
2

Print Resolution
4,800 x 1,200 dpi

Print Speed
8.5ppm (black), 6ppm (color)

Weight
4.17kg

Price
$79



Kudos to HP for managing to incorporate a 7-segment/icon LCD on a budget printer.



The printer supports both USB 2.0 Hi-Speed and Wi-Fi connectivity.



Like the Canon printer, it uses a tri-color cartridge for the cyan, magenta, and yellow inks.

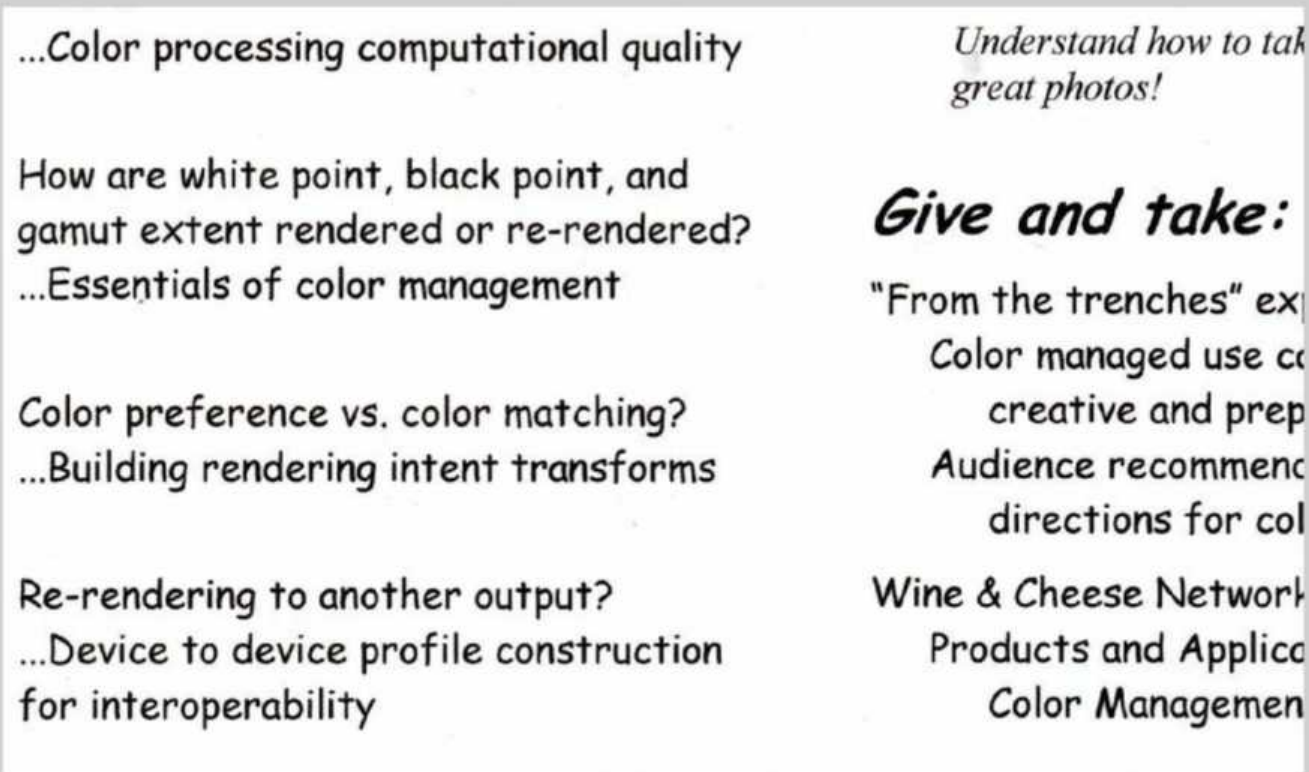
PRINT PERFORMANCE - CANON PIXMA MG2570S

In our lab, the MG2570S turned out a print speed of 4.1ppm for color and 8.2ppm for grayscale documents, putting it ahead of the pricier Epson XP-225. Its first-page-out speed was good too, as fast as 5 seconds for a typical Word document. An A4 color scan done at 300 dpi took about 21 seconds. We also did a 4R photo print using Canon's Photo Paper Plus Glossy II media, and that was ready in 42 seconds.

While the MG2570S' text output wasn't as dark as the Epson's, it was marginally sharper. Print dots were also slightly less visible in graphics. When we set the print quality to the highest setting for both, the Epson pulled slightly ahead, thanks to a more full-bodied text and more vibrant colors. But to our surprise, the MG2570S' photo printout actually looked very decent. Copy quality-wise, the MG2570S picked up fewer details than the Epson model.



Print dots are also not very visible, if you don't print big.



While not necessarily the thickest looking, text from the MG2570S is full-bodied and sharp.

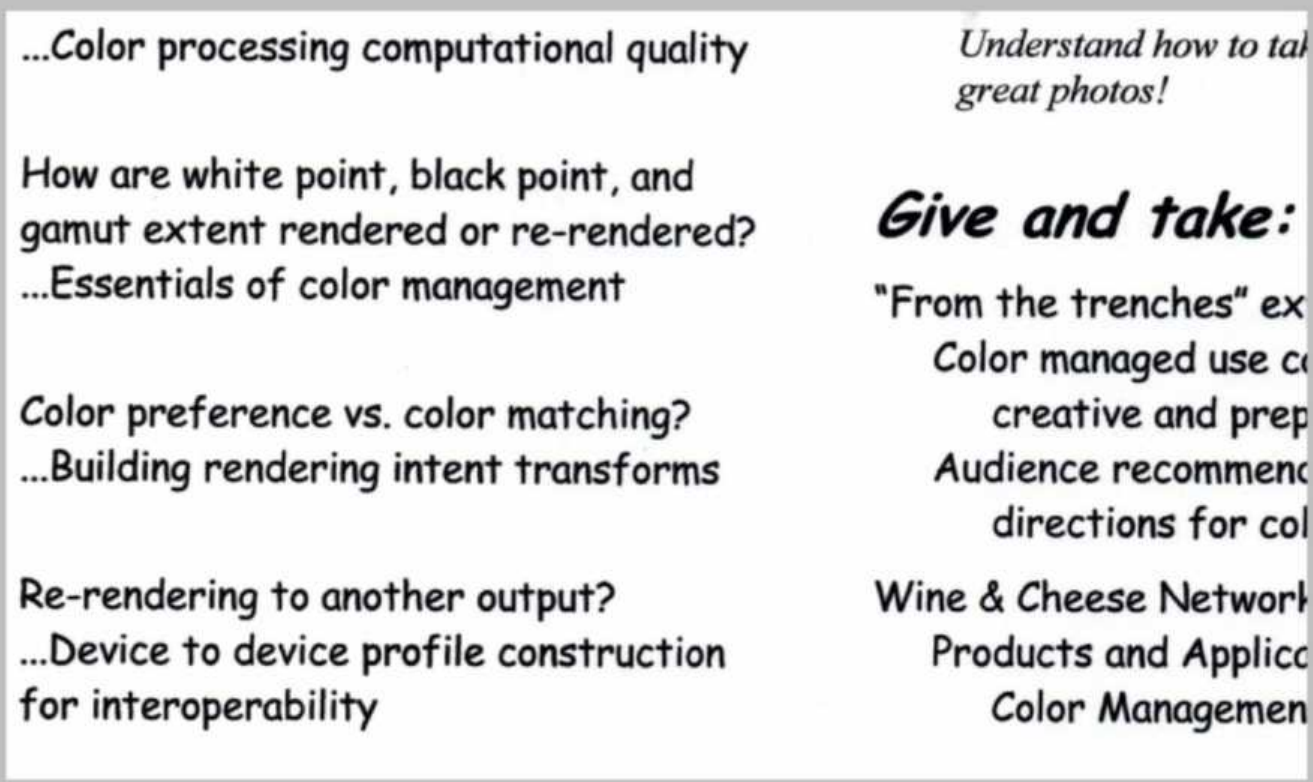
PRINT PERFORMANCE - EPSON EXPRESSION HOME XP-225

Based on our tests, the XP-225 hit around 2.9ppm for color document printing and 6.4ppm for black-and-white. In draft mode, which Epson rates at 26ppm for black and 13ppm for color, it did blow past the Canon printer, though the end result was very much lighter color text and graphics. Using the Epson Premium Glossy photo media, we managed a standard bordered 4R (4 x 6-inch) print in roughly 80 seconds.

As mentioned, we noted full-bodied text from the XP-225 but also slight edge fuzziness. That said, its copy and scan results were obviously better than the other two, something we attribute to the higher-res scanner. The photo printout also displayed natural colors and a good amount of detail. Coupled with individual ink cartridges that make more economic sense, the XP-225 gets our nod if photo printing is your priority.



Graphics and photos show good detail across the tones.



Text is very dark and full bodied at standard quality, but not so in draft mode.

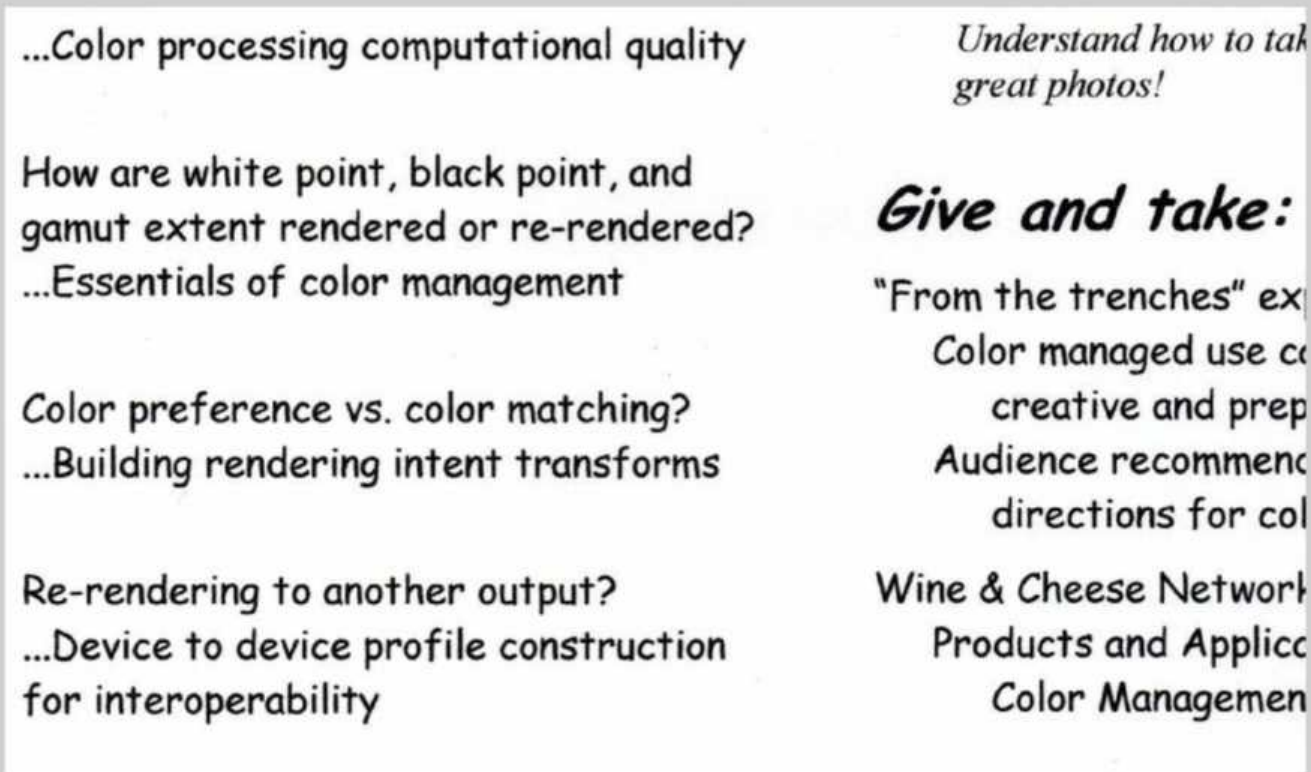
PRINT PERFORMANCE - HP DESKJET 3630

Looking at our test results, it's clear the DeskJet 3630 is the fastest of the three printers. For black-and-white and color printing, it achieved speeds of 9.2ppm and 6.3ppm respectively. Even when printing in draft and high quality modes, it was faster than both the Canon and Epson models. For a 4R photo print, it turned in a respectable timing of just under 60 seconds.

Image quality-wise, the Canon printer holds a slight edge over the Epson and HP printers as we observed less edge fuzziness on its printouts. In draft mode however, the DeskJet 3630 has taken a more balanced approach than the Epson printer, with comparatively darker text and clearer (though low-res) graphics. At the High quality setting, the DeskJet 3630 was more than a match for the other two with dark text and smooth color gradations in graphics. The fact that it prints fast is the icing on the cake.



Color transitions in graphics are well handled too.



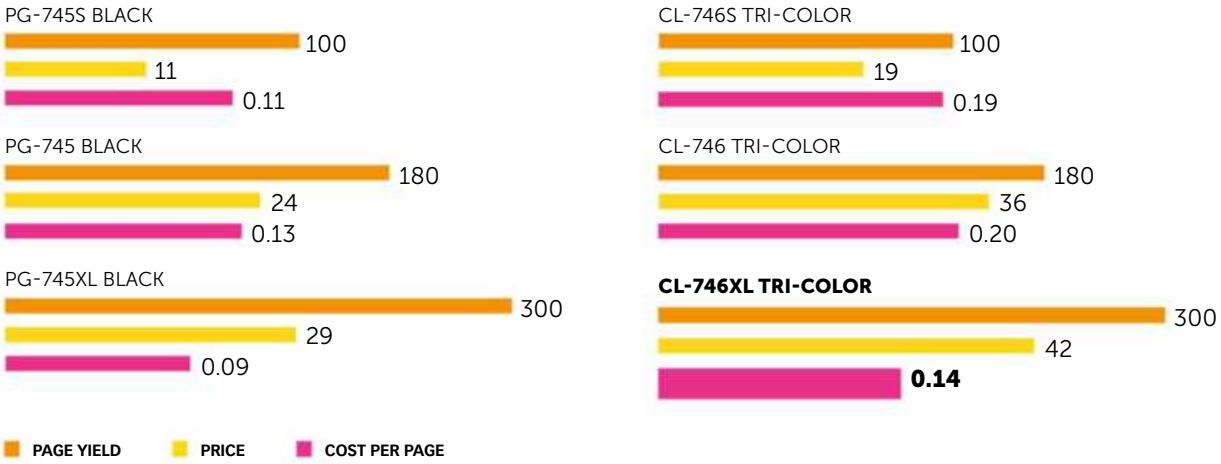
Consistent print quality across most settings, though slight edge fuzziness can be seen occasionally.

INK CARTRIDGE PRICES

Two key reasons the Pixma MG2570S and DeskJet 3630 can be sold at such affordable prices are because they use tri-color ink cartridges and the fact that their bundled cartridges don't hold a lot of ink. If you do print a lot, we suggest going for the Epson XP-225 instead. While the initial cost is higher, the page yield numbers for the cartridges are higher and the cost-per-page numbers for both mono and color printing are lower. That said, the numbers do get closer when you buy the high-yield 'XL' cartridges for the Canon and HP printers.

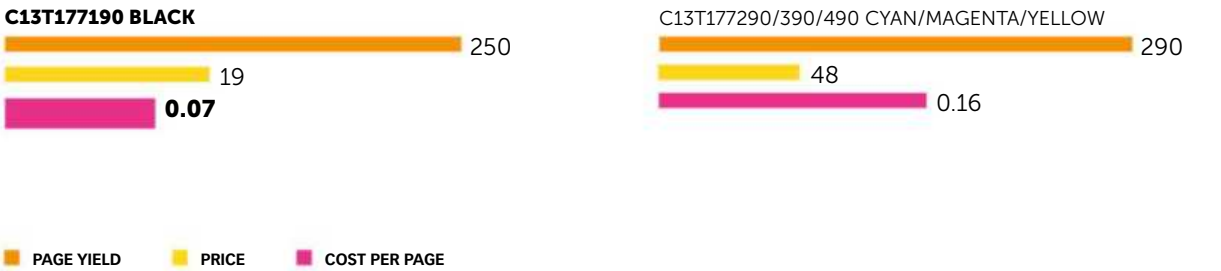
Canon Pixma MG2570S

(Cost per page, lower is better)



Epson Expression Home XP-225

(Cost per page, lower is better)



HP DeskJet 3630

(Cost per page, lower is better)









MODEL	CANON PIXMA MG2570S	EPSON EXPRESSION HOME XP-225	HP DESKJET 3630
PRINT SPEED	8 ipm (B/W) / 4 ipm (color)	6.2 ipm (B/W) / 3.1 ipm (color)	8.5 ppm (B/W) / 6 ppm (color)
PRINT RESOLUTION	4,800 x 600 dpi	5,760 x 1,440 dpi	4,800 x 1,200 dpi
NO. OF CARTRIDGES	2	4	2
SCANNER OPTICAL RESOLUTION	600 x 1,200 dpi	1,200 x 2,400 dpi	1,200 dpi
COPY SPEED	1.6 ipm (color, ISO)	15 cpm (color, draft)	3.5 cpm (color, laser-comparable)
PAPER INPUT	60 sheets (plain paper)	50 sheets (plain paper)	60 sheets (plain paper)
INTERFACE	USB 2.0 Hi-Speed	USB 2.0 Hi-Speed, 802.11b/g/n Wi-Fi	USB 2.0 Hi-Speed, 802.11b/g/n Wi-Fi
DIMENSIONS	426 x 306 x 145mm	390 x 300 x 145mm	438 x 310 x 158mm
WEIGHT	3.5kg	3.9kg	4.17kg
PRICE	$59	$128	$79

IPM VS. PPM

Before 2009, a printer's print speed was always measured in PPM (pages per minute). In theory, a higher PPM rating is better than a lower one, right? Wrong! The problem was that each manufacturer had its own way of doing PPM speed measurement. In essence, comparing Printer A's PPM against Printer B's PPM value was like comparing apples to oranges. To solve this issue, an ISO standard was introduced in March 2009; and for participating manufacturers, they usually use IPM (images per minute) as the unit of measurement. That said, there are some who continue to use PPM even though they follow the ISO standard; the only way for you to know is to read the fine print in the brochures.

AND THE BEST BUDGET INKJET AIO IS



HP DESKJET 3630

We'll be frank here: if you print a lot, none of these printers is for you. Looking at their duty cycles and the page yield numbers of their cartridges, they are more for home users or students with modest printing needs. The Epson Expression Home XP-225 is perhaps the most 'professional' of the three, but it costs more. You get better resolution, plus its cost-per-page numbers are actually the most attractive. On the other end, the Canon Pixma MG2570S is the most affordable of the bunch with surprisingly good print quality. Our main gripe with it is its lack of wireless connectivity.

And finally, we've the HP DeskJet 3630. It's $20 more than the Canon, but it prints fast and is equipped with a very good feature set for the price. Image quality-wise, it's on a par with the other two for the most part. For consistently punching above its weight, it's therefore our best recommendation for this shootout.



ANYTHING CAN HAPPEN IN THE NEWSROOM, ESPECIALLY AT A TIME WHEN TECHNOLOGY IS REINVENTING MEDIA. IT'S INSPIRING TO WORK WITH A YOUNG AND GUNG-HO TEAM, WHO CONSTANTLY CHALLENGES AND IMPROVES THE WAY WE PRODUCE AND DISTRIBUTE VIDEO.

Jonathan Ng
EDITOR
SPH RAZOR

PEOPLE WITH PASSION

PHOTOGRAPHY **VEE CHIN** LOCATION **MAD MUSEUM OF ART & DESIGN**

G-SYNC SHOWDOWN

You've started to see them around and probably wanted to know what these new G-Sync monitors are all about, whether you needed one, and if so, which should you get. Draw your blasters and swords, keyboards and mice, it's about to get messy in here.

Text by *Salehuddin Husin*
Photography by *Frenchescar Lim + Vernon Wong*
Art Direction by *Ian Chong*



VS

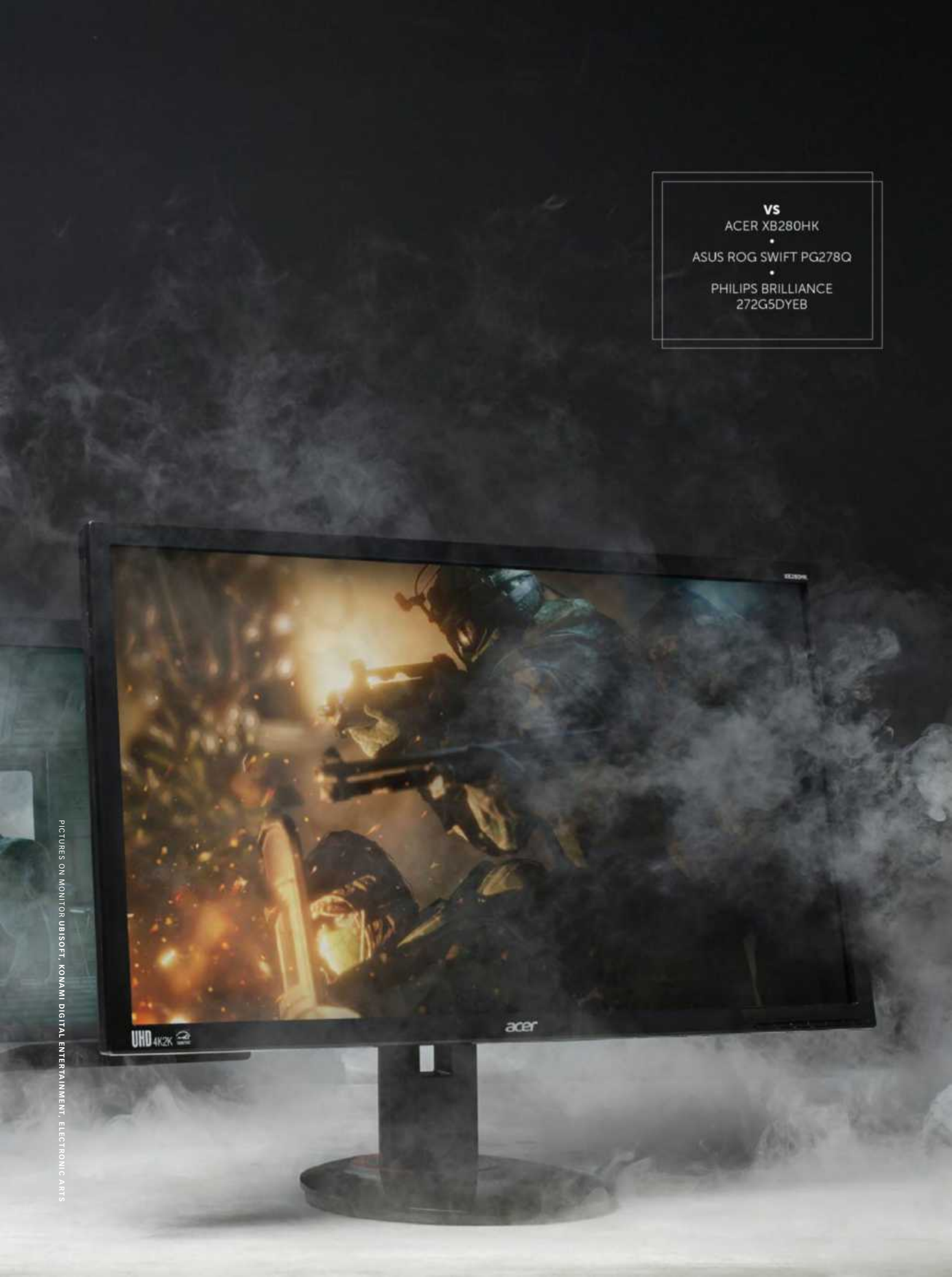
ACER XB280HK

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ASUS ROG SWIFT PG278Q

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PHILIPS BRILLIANCE 272G5DYEB



PICTURES ON MONITOR **UBISOFT, KONAMI DIGITAL ENTERTAINMENT, ELECTRONIC ARTS**

ACER XB280HK

The Acer XB280HK is the cheapest of the monitors in the shootout, and also the largest. At 28-inches, it has a 4K resolution (3,840 x 2,160 pixels) at 157.35 pixels per inch.

The monitor isn't all that special to look at though. It has a slim 1.5cm bezel all around, giving it a certain symmetry, but with a recessed panel (around 5mm), it draws unwanted attention to the bezel.

The monitor comes with a more attractive glossy base, propped up on a solid stand that actually offers a wide range of motion including height, tilt and orientation adjustment.

As for physical ports, you get two USB 3.0 ports on the left and two under those. Display settings and controls are all handled through physical buttons on the front.

The monitor is the only entry with a 60Hz refresh rate, but this is actually a technical limitation of the current DisplayPort specification, which doesn't have the bandwidth to support high resolutions with a high refresh rate.

To test the monitor, we watched a handful of 4K videos, a NASCAR video at 1080p and the Avengers: Age of Ultron trailer at 1080p60. While most colors were sharp, we noticed the red tones to be a bit washed out, on both Iron Man's armor and the NASCAR vehicles. One thing to take note, the viewing angle of the Acer monitor quite shallow. Generally, you're going to have to use this monitor head on unless you actualy like looking at a washed out display from the sides.

As the Acer XB280HK can go up to 4K resolutions, we tried playing Tomb Raider. We're pleased to note that Lara looks really good in 4K, with the textures looking particularly great.

4K for cheap.

Low refresh rate.

G-Sync works well on the Acer display, just like it does on the other monitors we tested. While performance in Tomb Raider is hardly optimal in 4K, there's visibly less tearing and stuttering, even when frame rates were less than ideal. While G-Sync helps to levels the playing field, the monitor's native 60Hz refresh limitation works to its detriment when G-Sync is disabled.

Sadly, even though the Acer XB280HK is a G-Sync monitor, it doesn't have any special gamer options such as hardware crosshairs.

Still, the Acer is a decent choice for a large, 4K capable display that just so happens to also support G-Sync.



AT A GLANCE

Resolution
3,840 x 2,160 pixels

Screen Size
28-inch

Aspect Ratio
16:9

Refresh Rate
60Hz

Price
$899



The Acer display has two USB 3.0 ports on its left side, and two more facing downwards.



The display on the monitor's a bit recessed, which gives it a sunken in look.



The monitor's buttons are all physical and easily accessed.

ASUS ROG SWIFT PG278Q

The ROG Swift PG278Q is a 27-inch monitor with a 2,560 x 1,440 pixels resolution (108.79ppi).

Of all the monitors in the shootout, this is the sleekest with its modern angular design. At just 0.5 cm on the top and sides (1 cm on the bottom), the whole monitor is almost all display. If you're opting for a multi-monitor setup, this will be your best bet.

Like all the others, the monitor's stand allows adjustment of height, can rotate to either portrait or landscape orientation and tilt.

Although the monitor has four USB 3.0 ports, two of them are facing downwards, which makes accessing them tricky - you'll need to rotate the monitor to access them. Menu navigation on the ASUS monitor is done via physical buttons and a small analog nub. We really prefer the nub since it makes selection and moving between menus really intuitive.

Video connectivity is handled by DisplayPort, though the PG278Q is the only monitor with the ability to change its refresh rate on the fly; you can switch between 60Hz, 120Hz and 144Hz with a press of the Turbo button. This is an extremely useful feature if you don't intend to use G-Sync or not running on a supported NVIDIA GPU.

We watched the same videos we did with the Acer monitor to see how the display holds up. Unlike the Acer's washed out looking reds, colors on the ASUS were much brighter, particularly on Iron Man's Hulkbuster armor. Viewing angles remain as bad though, which is a characteristic of the TN panels used in all three monitors here.

Tons of gamer-centric features.

Pricey.

For gamers, the monitor contains GamePlus technology, which allows the toggling of embedded crosshairs. These should make shooters easier to in theory but we found them to be obtrusive at times. You can also set timers to remind you of cooldowns in MMO and MOBAs.

It also has the widest support for other NVIDIA graphics technologies such as ULMB (Ultra Low Motion Blur) and is NVIDIA 3D Vision ready. ULMB is an alternative to G-Sync. It is kind of a hack to reduce the effects of motion blur appearing on screen by strobing the monitor backlight. However, it works best on higher refresh rate settings. You should be able to choose between G-Sync or ULMB via the latest GeForce drivers.



AT A GLANCE

Resolution
2,560 x 1,440 pixels

Screen Size
27-inch

Aspect Ratio
16:9

Refresh Rate
60Hz, 120Hz, 144Hz

Price
$1,259



The bottom facing ports are the hardest to access. You'll probably need to rotate the monitor.



The Asus monitor has the thinnest bezel.



The ASUS monitor uses physical buttons coupled with an analog nub. It makes OSD navigation a breeze.

PHILIPS BRILLIANCE 272G5DYEB

The Philips Brilliance 272G5 isn't as fancy as either Acer or ASUS monitors. It doesn't have a slew of gamer-centric support and it comes with a pretty basic 1,920 x 1,080 pixels Full HD resolution. For a large 27-inch monitor, the low pixel count is quite telling.

For some reason, it is also designed with unevenly-sized bezels; the top is 2.5cm, the sides 1.8cm and the bottom 4cm. This makes the monitor look squat and not very ideal for multi-monitor setups.

Like the rest though, it offers height, orientation and tilt adjustments. The monitor's DisplayPort and four USB 3.0 ports are all located together behind the screen and are easy enough to get to.

High refresh rate.

Low resolution.

The best feature of the Philips are its touch-based menu controls. They aren't as intuitive as the analog nub on the ASUS, but they are very responsive. It's a shame then that the monitor is sorely lacking in customization options, with no presets even. If you wanted to access color calibration functions, you'll have to download the Philips Smart Control software.

With a refresh rate support up to 144Hz, the Philips monitor has no issues keeping up with fast movement. Unlike the ASUS monitor though, there's no way to manually change this. Still, even if you're not running G-Sync, the monitor's high refresh rate will ensure it has no trouble any content.

Of the three, the Philips monitor has decent display quality on its default setting despite having the lowest resolution. It's a bit better than the Acer monitor, especially when it comes to colors but they aren't as sharp as they are on the ASUS display. It also uses a TN panel, so expect very narrow viewing angles. Move a bit out of the sweet spot in the center and image quality starts to suffer.

Philips also tries to cater to the gaming crowd, though not as extensively as ASUS. The monitor can create hardware crosshairs, though other options like ability timers are missing.

Where ASUS guns for premium positioning with a slew of features and Acer entices with its affordable 4K option, the Philips feels rather bland with no redeeming features to justify its price.



AT A GLANCE

Resolution
1,920 x 1,080 pixels

Screen Size
27-inch

Aspect Ratio
16:9

Refresh Rate
144Hz

Price
$1,059



Unlike the other monitors, the monitor has all of its ports in one place.



The Philips monitor's the only one with touch-sensitive buttons. All the others have physical ones.



The big rounded base on the Philips monitor gives it a very stable look.

WHAT IS G-SYNC?

The issues plaguing most gamers are threefold; tearing, input lag and stuttering.

Tearing is the term used when there are two different frames being shown during a single refresh cycle. A tear line right now the middle of the image is clearly visible, as it separates the two different images.

Input lag and stuttering goes hand in hand. Stuttering is caused whenever the GPU frame rate is below the display's refresh rate. When a scene stutters, it introduces latency into the mix, which causes input lag, or a delay between a button press and it being replicated in-game.

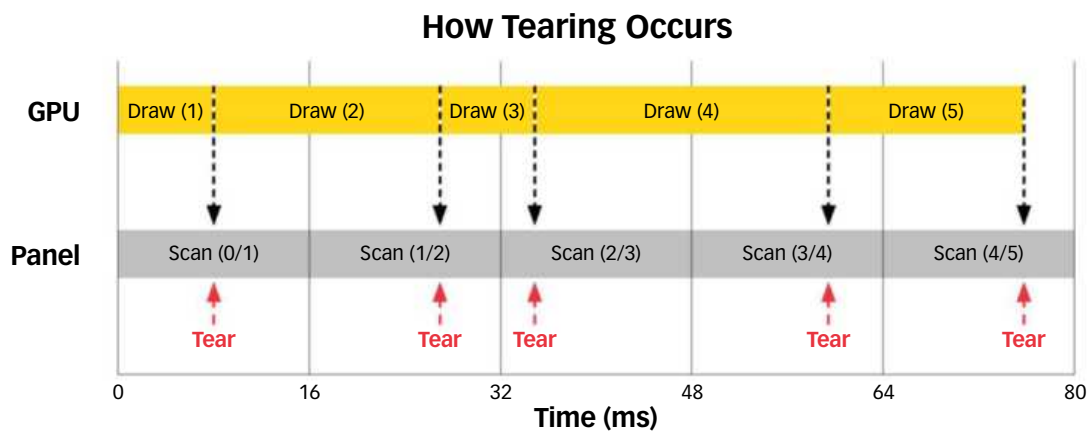
Monitors typically follow certain refresh rates, 30Hz, 60Hz and so on. For a long time, they were stuck there, which means a monitor with a 60Hz refresh rate can only display 60 frames a second, or a frame every 16 milliseconds. A GPU however, renders a scene at an inconsistent rate. A taxing scene will take longer than a simple one, which means the draw rate isn't the same throughout. The GPU's inconsistent draw rates and the fixed refresh rates of the monitors are the cause behind tearing, stuttering and input lag.

To combat these issues, NVIDIA introduced G-Sync, which forces the GPU and the monitor to work together by giving monitors a variable refresh rate. With that, monitors can now adapt to the pace a GPU renders a scene, which completely eliminates tearing and drastically reduces stuttering and input lag. Since most monitors don't have that capability, a special G-Sync module is needed for external monitors to enable G-Sync.

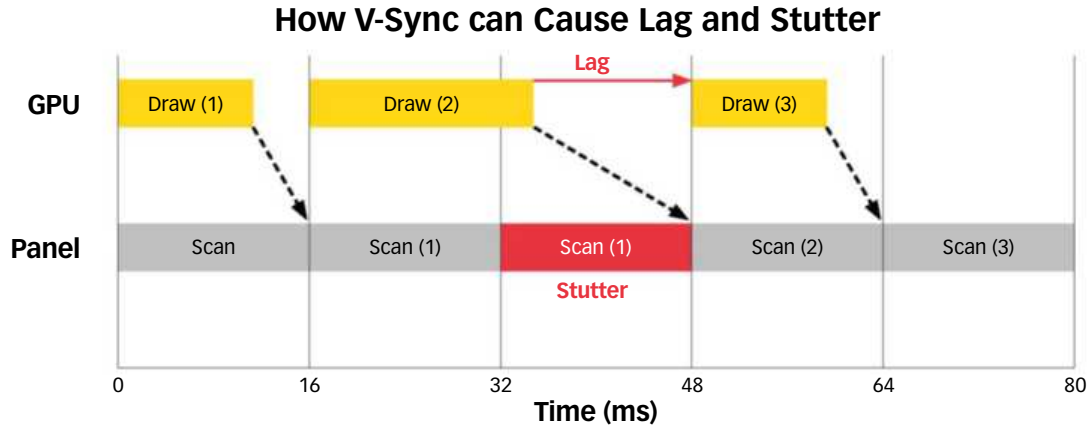
While it may sound simple in the theory, in practice the implications are easily visible. With tearing gone and input lag and stuttering drastically reduced, the 60 or even 30 frames per second ideal isn't as important as before. Frame rates in the 20s are actually playable, smooth and relatively input lag free.

Since a stable and smooth performance is now achievable even with 30 frames per second, PC gaming will no longer be a constant race to upgrade every year or two. True, there'll still be enthusiasts who want the very best, but for your everyday gamer who just wants to have a decent experience, a run of the mill gaming rig might actually be able to last longer before becoming obsolete.

Since G-Sync monitors command a premium over regular monitors, it is a sizable investment for most users. Still, it's arguably a better choice than replacing the GPU every few years. After all, replacing the GPU doesn't eliminate tearing, input lag or stuttering, it simply reduces their effect. A G-Sync monitor on the other hand can completely eliminate tearing due to its variable refresh rate, and minimize input lag and stuttering, even on aging hardware.



The GPU sends rendered frames to the monitor whenever it is ready. In these instances, a new frame is sent to the monitor even when the older frame is still being displayed causing the image to "tear".



Tearing can be solved by enabling V-Sync, which forces the monitor to refresh at fixed periods, but in instances where the GPU cannot render fast enough and misses the refresh timing, users will experience lag and stutter.







MODEL	ACER XB280HK	ASUS ROG SWIFT PG278Q	PHILIPS BRILLIANCE LCD MONITOR 272G5DYEB
SIZE	28-inch	27-inch	27-inch
RESOLUTION	3,240 x 2,160	2,560 x 1,440	1,920 x 1,080
ASPECT RATIO	16:9	16:9	16:9
REFRESH RATE	60Hz	60, 120 or 144Hz via Turbo button	Up to 144Hz
RESPONSE TIME	1 millisecond	1 millisecond	1 millisecond
PORTS	4 downstream USB ports, 1 upstream	4 downstream USB ports, 1 upstream	4 downstream USB ports, 1 upstream
INPUT	DisplayPort	DisplayPort	DisplayPort
DIMENSIONS	56 x 66 x 24.5cm	36.5 x 62 x 24cm	58 x 64 x 25cm
WEIGHT	7.8kg	6.9kg	7.8kg
PRICE	$899	$1,259	$1,059

REFRESH RATE AND RESPONSE TIME: WHAT ARE THEY AND WHICH IS MORE IMPORTANT?

Refresh rate is simply a measure of how many frames a display can show in a second. A monitor with a refresh rate of 60Hz per second for example, can draw 60 images in a second. If you're watching video, the extra frames being rendered can make a scene appear surreal, though games benefit from the extra smoothness.

Response time is completely different from refresh rate. Response times simply measures how fast a pixel on the display can change from grey to a color and then back to grey. A slow response time would create motion blur around fast moving objects. Some slower monitors also use a technique known as Overdrive to force faster response times from the monitor. While it does boost the response times, the trade-off is that Overdrive can produce halos on fast moving images.

As for which one is more important, it depends on what you're going to be using the monitor for. Even as a gamer, it'll depend on if you're a console gamer or PC.

If you're on a console, definitely go for the lower response times. No console game to date has broken the 60fps mark, which means a higher refresh rate is wasted. On a PC, it depends on your preferred genre. FPS games need fast refresh rates to keep up with the action, while slower paced games like strategy games benefit more from a faster response time, which gives better color accuracy.

AND THE BEST G-SYNC MONITOR IS



ASUS ROG SWIFT PG278Q

While it might be priced higher than the others, the ASUS monitor is clearly catered for gamers, the market G-Sync technology was designed for.

With its wealth of gamer-centric features, the monitor provides the most flexibility to gamers no matter what genre they're playing. While it is quite NVIDIA biased in terms of hardware support, its adjustable refresh rate means that non-NVIDIA users can take advantage too. No other display in this shootout supports this.

On top of that, the default picture quality for the monitor is also the best among the three, with a sufficiently high resolution for advanced gaming and an intuitive control option for fast navigation of built-in menus.



LORD OF THE PASSWORDS

The strongest passwords are those that are unpredictable and random. But, have you ever made them so complicated that they become hard to remember? The solution, use a password manager. Here are four of the most popular password managers around. Find out which is the most secure and easiest to use.

Text by *Kenny Yeo*
Photography by *Jasper Yu*
Art Direction by *Ian Chong*


VS
1PASSWORD
•
DASHLANE
•
LASTPASS
•
ROBOFORM

1PASSWORD

1Password is one of the more established password managers around with a ton of useful features including a password generator, auto-login and auto-fill functionality. It also saves your credit card details and allows users to create password-protected notes. In fact, 1Password is unique in that it allows users to save lots of other information including bank account numbers and details, driver license details, and even your router login information.

Installing and setting up 1Password was a breeze and requires users to download the app and then install the appropriate extension for their browser. This is pretty much the standard installation and setup procedure for all password managers, so no surprises there. Once you launch 1Password, it will prompt you for a master password. This master password is not stored on 1Password, so if you forget it you are in big trouble. Fortunately, unlike its competitors 1Password encourages users to enter a password hint, but this is a double-edged sword. On one hand it can save you the agony of losing access to all your passwords, but if your password hint is too obvious, it may allow others to gain to guess your master password.

1Password's is easy to use and navigate, but it isn't the most attractive. For OS X users, there's an additional 1Password Mini interface that appears a small icon on your menu bar. This lets users quickly generate passwords and login to their saved accounts. Windows users fear not, because this same functionality is available when you install the 1Password extension for your web browser.

However, unlike Dashlane, 1Password's auto-login feature is not as hands off. To be exact, 1Password's auto-login feature only works if you select the site you want to login from the app itself, either through the main application interface or the 1Password Mini interface. It's not a deal breaker by any means, but it is less intuitive and convenient.

Easy to use and provide analysis of all your passwords.

Not free to use. Some features not very intuitive.

One of the most helpful features in 1Password is "Security Audit", which highlights weak passwords, duplicate passwords and also highlights which passwords are old. This allows you to quickly identify which accounts and passwords then you need to change.

Like its rivals, 1Password also has apps for iOS and Android and it integrates well with them, allowing users to access their passwords and details on their mobile devices. Passwords and details can be synced across all devices and 1Password gives users the flexibility to choose the method that they want to use - over iCloud or Dropbox. 1Password recently introduced a new option through Wi-Fi, so password data never leaves a user's network. Passwords are synced across multiple devices using an encrypted keychain file developed specially by 1Password.

Finally, it's worth noting that unlike some of its rivals, 1Password is only available as a paid application. There's a free one month trial, after which you'll need to purchase a license.



AT A GLANCE

OS Compatibility
Windows, OS X, Android, iOS

Browser Compatibility
Chrome, Firefox, Safari, Opera

Price
US$49.99



As you create new accounts, 1Password will prompt you to save login details and passwords.



The 1Password Mini interface lets you quickly access key features of 1Password.



1Password lets you choose how you want to sync your passwords with other devices.

DASHLANE

Compared to the other password managers, Dashlane is practically a greenhorn. Released only in October 2012, it has made significant strides to become one of the more popular password managers in the market today. One of the reasons why it is so successful is because of its user-friendly interface.

Dashlane has all of the common features found on any respectable password manager, including a password generator, auto-login functionality, auto-fill of forms, password-protected notes, and is also able to save your credit card information and even generate receipts for your online purchases.

Setup was a fuss free process, requiring users only to install the application on their systems and then the appropriate extensions for their web browsers. Following which you need to create a Dashlane account and a master password. Like other password managers, Dashlane does not save your master password server, instead your passwords are saved locally on the device and the master password is used as a key to access Dashlane to decrypt data and gain access your saved passwords. The only time your passwords are sent to Dashlane's servers is if you choose to sync them across multiple devices, but even when doing so, this data is sent across Dashlane's servers in AES-256 encrypted form.

However, an important thing to note is since the master password is not stored on Dashlane's servers, there is no way for you to access Dashlane and all your saved passwords if you should forget the master password.

Most intuitive interface. Very secure system.

Free version has no backups. Could potentially lose all your passwords.

Dashlane does not give you the option of entering password hints either. Hence, of all the password managers, Dashlane's structure and method of handling your data is arguably the safest and most secure. For added protection you can even enable two-factor authentication through Google Authenticator.

Dashlane is also one of the easiest to use password managers. By default, it will offer to save your passwords as you log into your various online accounts or if you are creating new ones. The password generator also offers a couple of options. You can opt for numbers or letters only or both, add symbols, and as it generates passwords, it even gives a score of how strong they are. Other things we like is that fields that can be automatically filled up by Dashlane are highlighted with the Dashlane icon for easy identification, and that Dashlane automatically logs you into a website even if you manually enter the URL in your browser's address bar.

There's also the nifty Security Dashboard that shows all your accounts and generates a security score to give you an idea about how secure your accounts are, and also warns you if they are old or if they have been compromised. Most impressive is how Dashlane can help you change your password at a single click. Unfortunately, this feature only works for around 50 selected sites at the moment, but Dashlane does have plans to expand this list.

Dashlane is free to use, but it offers a premium version with more features such as account backup, syncing of passwords, web access to passwords and more for a yearly fee.

AT A GLANCE

OS Compatibility
Windows, OS X, Android, iOS

Browser Compatibility
Chrome, Firefox, Safari, Internet Explorer

Price
Free, premium at US$39.99/year



The Security Dashboard lets you check on your passwords in a quick glance.



Dashlane will automatically log you into websites if you have previously saved its login details.



You can save credit card details for easy online shopping.

LASTPASS

LastPass is a popular choice and it arguably offers the best compatibility across operating systems and browsers. It works with Windows, OS X and even Linux. For mobile devices, it works with iOS, Android and also Windows Phone and Blackberry. And as for browsers, LastPass provides integration with Chrome, Safari, FireFox, Opera and Internet Explorer.

And as you would expect, LastPass comes with all the features that a respectable password manager would have including a password generator, auto-login functionality, auto-fill of forms, password-protected notes, and is also able to save your credit card details and more.

Installation and setup was a breeze. Like its competitors, LastPass requires you to download an extension for proper integration with your browser. After this, users can proceed to create and account and a master password. Like the other password managers, the master password is not stored on LastPass' servers and is used only to gain access and decrypt the data that is stored locally on your device. This means that even if LastPass was hacked, they would not gain access to your master password, a point we'll come back to later.

Unlike its competitors, LastPass exists only in your browser as an extension and does not appear as a typical standalone application. Nevertheless, the interface is clear and easy to navigate and use. After installation, LastPass will also attempt to copy passwords stored in your browser, which will help you get up to speed more quickly and is a feature missing in other password managers. As you browse the web, LastPass will prompt you to save passwords and fill up forms. And as you populate your passwords and details into LastPass, fields that can be automatically filled up by LastPass will show an icon by its side, making it easy to identify and use.

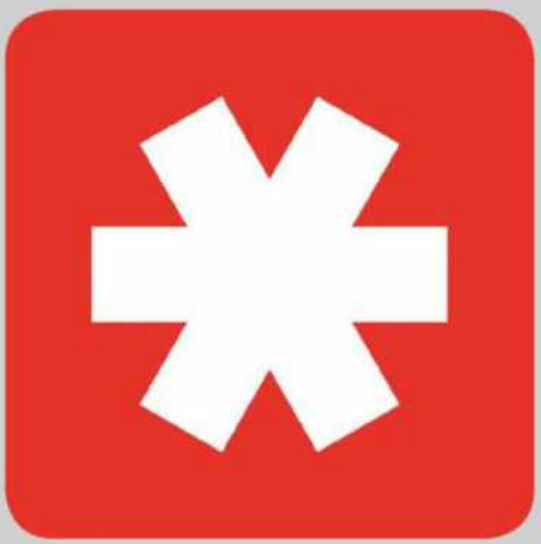
One particular nifty tool is the LastPass Security Challenge. It scans through all your saved passwords and warns you if there are any weak or duplicate passwords, it also tells you how old your passwords are and prompts you to change them. Finally, it generates a safety score to tell you just how safe your accounts and passwords are.

Free version does not miss out on much features.

Huge popularity makes it a target by hackers.

Similar to Dashlane, LastPass is free to use, but it also offers a premium plan for users who want more features for an affordable US$12 a year. If you need access to your passwords primarily on desktop systems, the free version of LastPass should suffice, as it syncs your passwords across multiple devices (but not on mobile). Subscribing removes advertisements, enables priority support, and most importantly, allows you access your passwords on mobile devices.

Unfortunately, it is worth noting that LastPass itself was recently subjected hacking. Although encrypted user data and stored passwords was not stolen, the hackers did make away with email addresses, password reminders and authentication hashes, LastPass did issue a warning to all their users to change their master passwords just in case.



AT A GLANCE

OS Compatibility
Windows, OS X, Android, iOS, Linux

Browser Compatibility
Chrome, Firefox, Safari, Opera, Internet Explorer

Price
Free, premium at US$12/year



LastPass can import your saved login details from your web browsers.



The Security Challenge is a good way to find just how safe your accounts are.



LastPass can also save details of your driver licenses and even club memberships.

ROBOFORM

RoboForm is one of the oldest password managers, having been around in some form since 1999. It works with all major desktop and mobile operating systems and integrates via an extension with all the popular web browsers.

Like its competitors, RoboForm comes with all the features you would expect to find on a password manager including auto-login functionality, auto-fill of forms, password-protected notes, the ability to save other important bits of information like credit card numbers, passport details and more.

Setup was a straightforward affair and after installation, users can choose from two modes of RoboForm - RoboForm Everywhere and RoboForm Desktop. As you might have guessed, RoboForm Everywhere syncs your passwords and lets you access your passwords from anywhere across multiple devices. On the other hand, RoboForm Desktop saves all your passwords on your desktop only. The former is certainly more convenient if you want to access your accounts on multiple devices, but it does pose some risks. The latter is more secure, but trying to access services on other devices would be a pain, especially with passwords generated by RoboForm.

Easy setup and free to use for 10 logins.

Missing more advanced key features like 2FA.

While installing RoboForm, it will also prompt you to install extensions on your browser. However, the way extensions are implemented across the various browsers is inconsistent. For example, RoboForm must exist in the form of a toolbar on Safari to work, which takes up valuable real estate, whereas RoboForm in Chrome is just a small icon on the toolbar. For Safari users, the RoboForm toolbar is a necessary evil as it allows quick access to RoboForm's various features, allowing you to quickly login to your saved accounts and also generate passwords for account creation, and also prompts you to save account details whenever you create new ones.

RoboForm's auto-login feature works in the same way as 1Password's, which is to say that it isn't as intuitive as we would like it to be. It works only when you select the site or service that you want to login from the app or extension itself, unlike Dashlane which takes care of everything automatically. Also, we noticed that RoboForm sometimes has problems saving the exact URL of the login page, which meant we had to manually cut and paste our username and passwords from RoboForm to complete the login process.

Unfortunately, RoboForm is missing out on some important features that we found useful in its rivals. For example, RoboForm does not provide an analysis of how safe or strong your passwords are, much less warn you that a service you are using is being compromised. Another feature missing is two-factor authentication, which would provide an additional level of security and peace of mind.

RoboForm is available for free, but the free version only saves up to 10 logins. This would probably not be enough for most users. The paid version of RoboForm Everywhere costs US$19.95 per year, whereas RoboForm Desktop for Windows and Mac OS X is available for US$29.95 per device.



AT A GLANCE

OS Compatibility
Windows, Mac OS X, Android, iOS

Browser Compatibility
Chrome, Firefox, Safari, Opera, Internet Explorer

Price
Free, US$19.95/year, US$29.95 for RoboForm Desktop



RoboForm Everywhere lets you access your saved details across multiple devices.



If you are using Safari, you can access RoboForm's password generator from the RoboForm toolbar.



On Macs, RoboForm can be accessed from the menu bar to gain quick access to accounts.

HOW DOES A PASSWORD MANAGER KEEP YOU SAFE

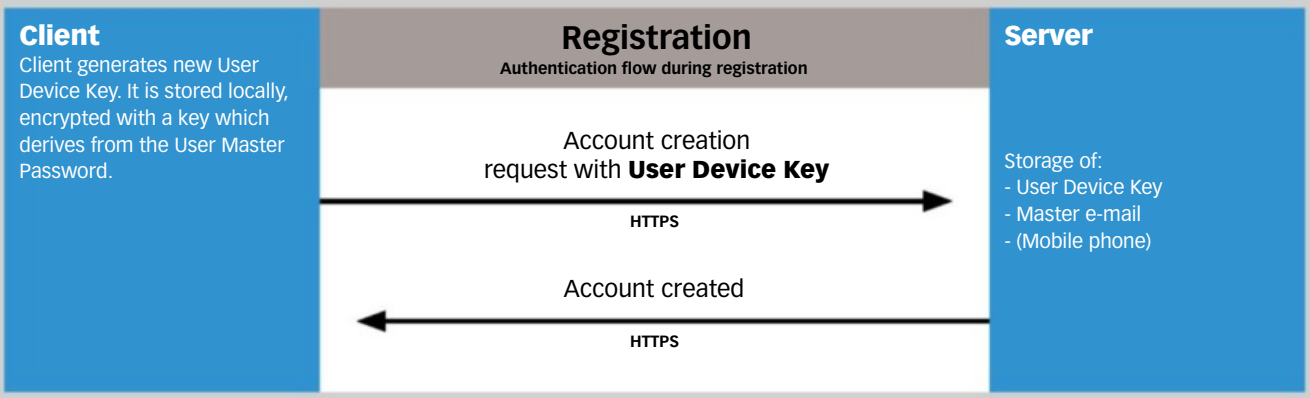
The idea of a password manager is simple. It saves all your passwords in a nifty app and helps you remember them so that you don't have to. To access these passwords, all users need to do is remember a single master password. It is literally the concept of one password to rule them all.

However, the interesting thing is that the master password is never actually sent online to access your data. Instead, it acts as a key that gains you access into the password manager and your passwords. And for most password managers, the passwords that are saved within them are stored locally on the device in a heavily encrypted form using 256-bit AES encryption with PBKDF2 iterations. According to Dashlane's security whitepaper, a file with 256-bit AES encryption and PBKDF2 with 10,000 iterations would take a single quad-core Intel Xeon processor running at 1.87GHz over 1,700 years to decipher.

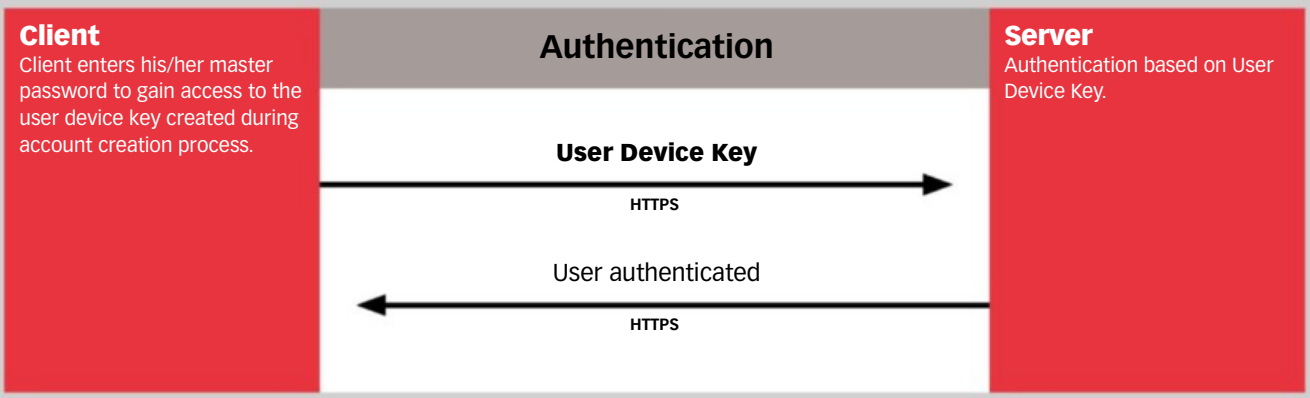
In other words, it is very difficult to hack into a user's account. Not only would the hacker need to physically steal your device, he or she would also need to know your master password. As a result, this is why some password managers, like Dashlane for example, do not even provide the option of giving users password hints, as that could jeopardize the entire system.

Furthermore, most password managers also carry out authentication based on devices. What this means is that only previously authorized devices can have access to passwords. For most password managers, it works like this: whenever a new device is added, a user device key is created which is stored locally on the device and also encrypted; only after the master password is successfully entered, is this device key then used to authenticate the login. This prevents hackers from using unauthorized devices to access the account.

That said, password managers are not fool proof. For example, the master password is the key and the entire system can be compromised by using a master password that is easy to crack. Also, if you happen to write your master password down some place, be sure to keep it in a safe place. Finally, if the computer has been physically compromised, by a keylogger for example, which captures keystrokes, then no password-based security system will be able to keep your data safe.



The User Master Password is never transmited over networks to servers, only the User Device Key is.



Similar to the registration process, the only keys stored on the password managers' servers are the User Device keys.

AND THE BEST PASSWORD MANAGER IS



DASHLANE

Dashlane offers the best blend of security, features and ease of use. Its Security Dashboard is a quick way to keep up to date on how secure your accounts are, and its auto-login feature was the best and most intuitive by far. Dashlane is even able to notify you if a particular website or service that you are using has been compromised. On top of that, Dashlane provides a great deal of freedom on how you can manage your passwords. For instance, you can choose to sync your passwords across multiple devices, or not. And should you turn off password syncing, Dashlane will immediately delete all of your data from its servers, removing hacking risks. It may have the priciest subscription rate, but considering its wealth of premium features, it's well worth it.

LASTPASS

If you want a password manager that offers the most bang for buck, LastPass is your best bet. Unlike the other password managers, the free version of LastPass is almost as good as the paid option. Multi-platform password syncing will require a paid subscription, but even then, LastPass is very affordable at just US$12 a year or US$1 a month. In terms of ease of use and functionality, LastPass is a good match for Dashlane. We like how LastPass clearly indicates fields that it can fill up based on details that you have already saved into LastPass. Additionally, we also appreciate its Security Challenge feature that analyzes your passwords and tells you if any of them are old, weak or duplicates.



LONG AWAITED, BUT MUCH IMPROVED?

Jawbone Up3

AT A GLANCE

Connectivity
Bluetooth 4.0

Battery Life
Up to 7 days

Weight
29g

Price
$309



Smart Coach offers suggestions to help you lead a healthier and more productive life.

CONCLUSION

Pricey and difficult to wear, the Jawbone Up3 is saved only by its excellent app.

TESTED & RATED

7.0/10

HWM SINGAPORE

It's been a long wait, but the Jawbone Up3 is finally here. Announced late last year, the Up3 was only available in July this year. The reason, we are told, is to due manufacturing difficulties. As a result, the Up3 isn't water resistant up to 10 meters originally stated. Instead, it is splash-proof and shower-proof, which should still be good enough for most in everyday activities and chores.

The Up3's design is markedly different from the old Up24. Instead of a coil around your wrist, the Up3 uses a more conventional clasp design with a hypoallergenic TPU rubber strap and anodized aluminum case. Unfortunately, the clasp is tricky to operate with just one hand. And even though it is adjustable, we never really got a good enough fit. Worse of all, the clasp seems to loosen with wear; after just a couple of days, it became looser than we would have liked.

The Up3 typically offers pedometer functionality and can monitor the quality of your sleep. But sleep tracking is now more detailed as the Up3 tracks up to three sleep stages - light, deep and REM. Also new to the Up3 are bio-impedance sensors which measure heart rate. However, the Up3 doesn't give you real-time readouts; only your resting heart rate - your heart rate at the time when you wake up. According to Jawbone, resting heart rate provides a better sense of your overall health and fitness levels.

On top of that, the Up app is still the best in the business today. It's easy to use and offers detailed analyses of activity levels. What we really like is the Smart Coach feature, which gives wearers personal insights into their lives and offers recommendations on what to do to live healthier. For instance, if the app notices that you have been sleeping less this week, it will prompt you to sleep earlier tonight.

Even with its considerable tracking abilities, it is hard to deny that at $309, the Up3 is incredibly pricey for just an activity tracker. For that kind of money, you'd be looking into the ballpark of a smartwatch instead. Our recommendation is to go for the more affordable Up2. It does almost everything the Up3 can - minus heart rate and advanced sleep tracking - at a much more palatable price point.

by *Kenny Yeo*

PICTURES JAWBONE

FLASH FOR THE MASSES

OCZ Trion 100 SSD

AT A GLANCE

Capacity
240GB

Controller
Toshiba TC58

Memory type
Toshiba A19nm TLC

Price
$135



OCZ's SSD Guru makes it easy for users to check their drive's status.

CONCLUSION

A solid entry-point to the world of flash storage performance.

The OCZ Trion 100 SSD is one of the most affordable drives in the market today. This is made possible by employing newer TLC (Triple-Level Cell) NAND, which increases storage per NAND die at the cost of lower endurance and performance.

Besides OCZ, only rivals Samsung and SanDisk have released TLC NAND drives, but as NAND manufacturing and controller technology improves, manufacturers are bridging this gap and we can expect TLC NAND to be the next mainstream.

As for the Trion 100 SSD, its internal components are all sourced from parent company Toshiba. Specifically, Toshiba's new A19nm 128Gbit TLC NAND and TC58 controller. It also uses a standard SATA 6Gbps interface.

According to OCZ, the Trion 100 SSD will be the new entry-level model, sitting below the ARC 100. However, the ARC 100 will not be retired as it is sufficiently different in performance and pricing to warrant its continued existence.

Given its humble positioning, it should come as no surprise that performance isn't one of the Trion 100 SSD's strong suits. Read speeds are respectable and on a pair with most mainstream with SSDs, but write speeds are predictably poor, especially at high queue depths. This is something we're seeing with all TLC NAND drives, so it is nothing out of the ordinary.

Although Toshiba doesn't disclose the specifics of the controller's workings, we are guessing that there is some kind of caching technology at play here. This would not be unusual because TLC NAND drives from Samsung and SanDisk both employ caching technologies to boost write performance.

Even though its performance is considered less than stellar, the truth is that casual users shouldn't notice the difference, especially if they're upgrading from a traditional mechanical HDD where the main use of a computer is for productivity and the web.

Endurance doesn't seem to be an issue either as OCZ is quoting up to 55GB writes per day for the 240GB model that is reviewed here. Considering that most users would only rack up between 10GB to 30GB of writes per day, it is safe to say that the Trion 100 SSD will keep going for a long time. OCZ is also offering a 3-year warranty on the Trion 100 SSD.

by *Kenny Yeo*

TESTED & RATED

7.5/10

HWM SINGAPORE



PICTURES OCZ

COMPACT AND COOL

PowerColor Radeon R9 Fury X

AT A GLANCE

GPU Transistor Count
8.9 billion

Core Clock
1,050MHz

Memory
4GB HBM

Memory Clock (DDR)
1,000MHz

Price
$1,099



A row of LEDs above the power connectors light up according to the card's power consumption.

CONCLUSION

The Radeon R9 Fury X runs extremely cool and offers decent, although not leading, performance at resolutions exceeding 1080p.

TESTED & RATED

8.5/10

HWM SINGAPORE

After letting NVIDIA have free reign of the greater part of the GPU market for the first half of the year, AMD's riposte comes in the form of the Radeon R9 Fury X, and here, we'll be reviewing a reference design from PowerColor.

The Fury X is a one-of-a-kind card, not least because of its closed-loop water cooling solution and use of High Bandwidth Memory (HBM). It also features AMD's new Fiji GPU architecture and boasts a total of 4,096 shaders, 64 Compute Units, and 256 texture filter units, a 45% increase over the flagship Hawaii GPU on the Radeon R9 290X.

It has a core clock of 1,050MHz and memory clock of 500MHz (1,000MHz DDR). The latter figure may seem a little low if you're used to GDDR5 figures, but this is HBM, which makes up for the low speed with a ultra-wide 4,096-bit memory bus. This translates into 512GB/s of memory bandwidth, the highest available today.

And when it comes to build quality, the Fury X absolutely excels. The entire card is made up of multiple pieces of diecast aluminum, with the black aluminum exoskeleton complemented by a nickel-plated chrome finish bearing the Radeon logo. This is topped off by soft-touch sides that feel better made than most metal-and-plastic cooling shrouds.

The radiator sports a 120mm Nidec Servo Gentle Typhoon fan, which has a reputation for being one of the best radiator fans available. From our tests, the fan was capable of ramping up to a maximum speed of 3,000rpm.

Performance-wise, the card falls slightly behind the NVIDIA GeForce GTX 980 Ti overall, although it narrows the performance gap to within a few frames at quad HD and 4K resolutions. This is slightly disappointing considering their identical US launch price of US$649. The card also has locked memory clocks, and we were only able to overclock its core to 1,130MHz, which translated into a modest gain of about 5% in 3DMark 2013.

However, the card impresses in the cooling department, where it recorded a chilly peak temperature of just 45°C.

In sum, the Fury X has a lot of things going for it, but unrivalled performance is not one of them. It is compact, solidly built, runs very cool and does perform close to top NVIDIA cards. But if you're going to put money down on AMD, we'd actually recommend the pared-down R9 Fury instead.

by *Koh Wanzi*



PICTURES AMD

SIZE DOESN'T MATTER

Aorus X3 Plus V3

AT A GLANCE

Processor
Intel Core i7-4710HQ (2.5GHz, 6MB L3 cache)

Display
13.9-inch QHD+ (3,200 x 1,800 pixels)

Graphics
NVIDIA GeForce GTX 970M (6GB VRAM)

Memory
16GB DDR3L

Price
$3,699



The large vents on the X3 Plus V3 aren't for show so don't cover them up since the machine needs the cooling.

CONCLUSION

Pricey, but there's no other 13-inch notebook that comes close to delivering the performance you can get from the Aorus X3 Plus V3.

The Aorus X3 Plus V3 is the smallest gaming notebook from Aorus, refreshed to take advantage of NVIDIA's 900M series of graphics cards. The 13-inch machine looks like a miniaturized version of the immensely powerful Aorus X7 Pro, but is in no way underpowered with this update sporting a quad-core Intel Core i7 CPU and GeForce GTX 970M GPU.

One of the standouts of X3 Plus V3 is that killer 13-inch QHD+ (3,200 x 1,800 pixels) IGZO display, which makes everything look great. It also serves up good viewing angles and bright colors.

Like the Aorus X7 Pro, the X3 Plus V3 is a powerhouse, which is impressive seeing as how diminutive it is. The sleek black aluminum chassis that is the trademark of Aorus X series is back in full glory and it is spectacular. Measuring just 22.9mm thick and weighing a measly 1.8kg, the machine is compact and light enough to be carried around without any hassle.

The performance for the X3 Plus V3 is pretty much on par with what we expected. Running our benchmarks, the X3 Plus V3 kept pace with the other NVIDIA GeForce GTX 970M machine in the comparison, the ASUS ROG G751JT. While the Aorus machine did trail in most of the tests (except for 3D Mark 2013), the difference between the two machines were negligible. We suspect if it wasn't for the automatic GPU throttling (due to heat) that NVIDIA has, the Aorus machine might have outperformed the ASUS notebook.

Unfortunate, but due to the compact nature of the machine, it does tend to run hot. GPU-Z had its GPU running at 86-degrees Celsius at the highest point. The chassis itself tends to get warmer as you use it, though it never reaches the point of being uncomfortable. To be fair, the machine's thinness doesn't really leave much room for extensive cooling, and even the Aorus X7 Pro (which is a 17-inch machine) had high temperatures for both its chassis and GPU.

We were also a little disappointed that the X3 Plus V3 still suffer from the same issues as its predecessors. We'd had hoped that Aorus could have used these generational hardware updates to incorporate more visible tweaks to its design, but the keyboard and trackpad continue to be difficult to keep clean, while the glossy nature of the trackpad makes using it uncomfortable due to friction. Finally, the lack of depth in the keyboard keys means that typing is both uncomfortable and unsatisfying.

At $3,699, the Aorus X3 Plus V3 isn't what you'd call affordable. But what you get is a no-compromise gaming machine in a truly portable form factor. If the idea of full-fledged gaming on-the-go intrigues you, then it really doesn't get much better than this.

by *Salehuddin Husin*



TESTED & RATED

8.5/10

HWM SINGAPORE

PICTURES **AORUS**

LIGHTEST, THINNEST AND WATERPROOF?

Sony Xperia Z4 Tablet

AT A GLANCE

Operating system
Android 5.0 Lollipop

Display
10.1-inch 2,560 x 1,600 pixels (299ppi) IPS LCD

Processor
Qualcomm Snapdragon 810 Octa-core CPU (Quad-core 1.5GHz Cortex-A53 & Quad-core 2GHz Cortex-A57)

Storage
32GB internal storage (microSD support up to 128GB)

Price
$888 (Wi-Fi)
$988 (4G LTE)

After skipping a generation (the Z3 tablet only came in a compact 8-inch size), Sony is re-introducing its 10-inch flagship tablet in the form of the Z4 tablet. A direct successor to last year's Z2 tablet, the Z4 has been upgraded with a QHD display and a Qualcomm Snapdragon 810 octa-core processor.

If you're familiar with any of the products in Sony's Xperia Z range you already know what the Z4 Tablet looks like. Sony is once again utilizing its minimalist OmniBalance design, and at first glance there's really nothing to separate it from the Z2 tablet. But hey, if it ain't broke, why fix it, right?

The Z4 tablet is still one of the best-engineered tablets on the market, and is both ultra-thin at just 6.1mm and ultra-light at a mere 393g. That's the same thickness as Apple's iPad Air 2, but significantly lighter.

As with all of Sony's Z gadgets, the Z4 tablet is waterproof and rated IP68, meaning it's impervious to dust and can survive immersion in water up to 1.5m for 30 minutes. The waterproof build has also evolved and now includes a capless USB port removing the need for a fiddly port cover flap like on previous Z tablets.

To keep up with the likes of Samsung's Galaxy Tab S 10.5, the Z4 Tablet's new QHD 2,560 x 1,600-pixel resolution display translates to 299 pixels-per-inch. Clarity on the Z4 Tablet is top notch, although honestly it was hard to spot the difference between it and the 264ppi Apple iPad Air 2.

Like its predecessors, the IPS LCD display boasts Sony's Live Color LED and Triluminous display tech, although we found the colors to be a bit too vivid for our liking (there's an option in the Settings menu for a more neutral display, and we recommend using that instead). Viewing angles were good and contrast was also decent, although not as deep as the Samsung Galaxy Tab S 10.5's Super AMOLED display.



TAP FOR GALLERY

PICTURES SONY





The Z4 Tablet has been upgraded with a capless micro-USB port



The BKB50 keyboard (sold separately) turns the Z4 Tablet into a 10-inch laptop.

CONCLUSION

Still a top-notch Android tablet, but not much different from last year's model.

One of the stand out features on the Z4 Tablet is its front-facing stereo speakers. The volume can be cranked up nice and loud, although it starts to get a bit harsh at maximum volume. Don't expect a ton of bass, especially from a tablet this thin, but the speakers are still way ahead of other tablet offerings.

A new addition to Sony's accessory lineup is the BKB50 Bluetooth Keyboard, which is sold separately for a jaw-dropping $268. If you can get past the asking price, the keyboard is just as thin and light as the tablet, complementing it nicely to effectively turn the tablet into a 10-inch Android laptop, but it doesn't offer any extra functionality. There are no extra ports or an additional battery inside it, and the keys aren't backlit. It's also worth noting that the keyboard isn't dust or waterproof like the tablet, so don't take a shower with it.

Like Sony's Xperia Z3+ smartphone, the Z4 tablet is powered by a Qualcomm Snapdragon 810 Octa-core processor (Quad-core 1.5GHz Cortex-A53 & Quad-core 2GHz Cortex-A57). In our benchmark testing, it performed well, surpassing the rest of our tablets in both computing and graphics processing. One area where it disappointed however was battery life. The Z4 Tablet has the same 6,000mAh capacity battery as the older Z2 Tablet, which is quite small compared to the 7,340mAh battery found in the iPad 2, and the huge 7,900mAh battery inside the Galaxy S 10.5. With the addition of both a much higher resolution display, and a more power-hungry octa-core processor, battery life took a big hit on the Z4 and it lasted just over six hours in our video looping benchmark, nearly two hours less than the Z2!

The Xperia Z4 Tablet has a new display and a new processor, but it doesn't really feel like a new product.

It's still a fantastic device, but it delivers exactly what the Z2 Tablet did last year: great build, waterproof durability, minimalist design, and a top notch display and speakers. Comparing the two tablets, it's hard to say that Sony has really done much to improve on last year's model, other than bumping up its specs. And while the QHD display and octa-core processor are nice upgrades, when they come with a huge decrease in battery life, you have to consider if the trade-off is really worth it.

by *James Lu*

TESTED & RATED

8.0/10

HWM SINGAPORE

NEVER CEASES TO AMAZE

Sony RX100 IV

AT A GLANCE

Sensor Type
1.0-inch CMOS

Resolution
20.1-megapixels

Dimensions
101.6 x 58.1 x 41.0mm

Weight
298g (including battery and memory card)

Connectivity
NFC, Wi-Fi, Micro USB, HDMI

Price
$1,399



Even with a max usable ISO of 12,800, the RX100 IV amazingly doesn't sacrifice too much detail at this level.

The market demand for mainstream compact cameras is satiated by the slew of powerful smartphone, but premium compacts have been able to cement their place by providing much improved imaging performance without the need to go all-out on a DSLR. Sony clearly hit on a winner with their chart-topping RX100 premium compact and has been refining the formula ever since.

The reason why the RX100 line has been so well-received was simply because the pocket-sized shooter was speedy and comfortable, all while packing a sensor size that produced high quality pictures; a difference that was noticeable even when compared to the best of modern smartphones.

Three iterations ago saw connectivity and functionality improvements to the RX100 when Sony added NFC and Wi-Fi connectivity to the second version, and subsequently an electronic viewfinder plus a faster lens in the third. This time, the RX100 IV features an improved sensor - not in terms of sensor size or direct image quality, but speed. What Sony calls a stacked-type sensor is basically a similar 1-inch CMOS sensor with a DRAM chip tacked on directly to act as a buffer. This, according to Sony provides more than 5x image processing speeds compared to its predecessors

The RX100 IV also features 4K video recording and some new professional-level video functionality.

But before we wax lyrical about the updates, you should know that they come at a cost - $1,399 specifically, which is $200 on top of the previous opening price. Physically, there are almost no visible upgrades in size and shape, though Sony has kept the relatively user-friendly controls for tweaking in Manual mode.

Now, most of the camera's new super powers come from said stacked sensor design. For video, this translates to the ability to shoot up to 960fps, opening up opportunity for casual shooters to dabble with super slow-mo videos, such as balloon-popping or watching the ripples of cheek fat ebb around a slap. While it's not a game-

TAP FOR VIDEO



PICTURES **SONY**



breaking advancement, it does provide much more flexibility for interesting slow-mo montages than your iPhone can offer you. Our allusion to slapping friends for entertainment wasn't a coincidence.

There's also Speed Priority Continuous Shooting, which is a notch above standard Continuous Shooting found on almost every compact. The RX100 IV is capable of chugging out shots at 16 frames per second plus an electronic shutter that goes up to 1/32,000 sec, so you'll have the option of getting precisely the images you want even in a fast-moving or time-sensitive shot.

With its ultra-high speed shooting capability, the RX100 IV is also able to greatly reduce rolling shutter effects while shooting moving objects.

Performance-wise, the Sony RX100 IV once again pulls through with their reliability for such a tiny compact. Photos are sharp and accurate, with little to complain about. Through nitpicking, we did find out how robust the camera really can be despite being a point-and-shoot. Color is scarily accurate, and that's bearing in mind that Sony normally has the tendency to come up with weird tints for their imaging-related products on occasion. Color is only an issue during image preview on the camera LCD where the photos can appear to have a green or red tint. However, the final images exported out to our monitor remains consistent throughout all ISO levels, with little to no defects even at ISO 12,800.

This brings us to another of the RX100 IV's strength. Image quality is excellent even at higher ISO levels. To be specific, blurring can start at ISO 1,600 though detail loss is quite negligible – it only gives way at ISO 3,200, where sharpening in post won't salvage finer lines, but you'll get usable photos even at ISO 12,800.

With all these advantages, the RX100 IV tops it off with the old features that RX100 users are very familiar with –the compact yet ergonomic grip and feel, a smooth focusing ring with tactile diamond-embossed design, with a sexy 8mm – 25mm (24mm – 70mm for 35mm equivalent) Zeiss lens, and a wide aperture of f1.8 for that option of shooting delicious hipster-inspired bokeh pictures.

Even with all these powerful features and top quality performance, its $1,399 asking price means that most of us will still be sticking to our smartphones. There is no doubt about the innovation that went into the RX100 IV though and who knows, to some, a camera may just be worth its weight in gold.

by *Liu Hongzuo*



The electronic viewfinder has 100% field coverage, and a decent 0.59x magnification.

CONCLUSION

The RX100 IV has a borderline-insane price tag, but promises excellent quality and comfort.

TESTED & RATED

9.0/10

HWM SINGAPORE

WHEN A VALUE PERFORMER GETS MORE OOMPH

Nikon D7200

AT A GLANCE

Sensor
APS-C CMOS

Megapixels
24.2-megapixels

Dimensions
135.5 x 106.5 x 76 mm

Weight
approx. 675g (body only)

Price
$1,469 (body only)
$1,749 (with 18-105mm VR DX lens)

The Nikon D7200 is Nikon's latest flagship DX-format camera, building on its predecessor, the D7100, by adding a larger buffer, improved autofocus performance, Wi-Fi with NFC capabilities, better battery life and 60p video. It is also the first DX-format camera to get in-built time-lapse capabilities and even inherits certain features from the D750 such as Nikon's EXPEED 4 image-processing engine and Advanced Multi-CAM 3500 II autofocus sensor, which is sensitive to -3EV.

The D7200 is modelled closely after the D7100, which means similar weather sealing, build and overall weight. While that's not a bad thing, we were hoping Nikon would shift more cameras to their new monocoque treatment; like the D5500 and D750 before, it was one of the more significant developments from a traditional DSLR company to negate the size and weight advantages of mirrorless cameras.

There's also no change to the LCD display, which means it's fixed and non-touch sensitive. Again, this feels like another missed opportunity, as we really liked the implementation of touch to quickly adjust settings in the D5500 as well as the flexibility that Touch Fn brings.

However, physical features notwithstanding, Nikon's given the D7200 quite a bit of a boost under the hood. While the D7200 and the D7100 both have a similar 24-megapixel resolution, the D7200's sensor has 24.2 million pixels compared to 24.1 million on the D7100. This is significant mainly because the D7200 is probably using a newer sensor, explaining its two-stop increase in sensitivity

TAP FOR GALLERY



PICTURES NIKON





The D7200 features double SD card slots.



Images at ISO 25,600 display a fair bit of color noise.

CONCLUSION

A slew of upgrades under the hood make the D7200 a value purchase.

performance.

The D7200 also seems to have taken the needs of movie makers into greater consideration. There is now an additional menu specifically for movie options like highlight display, microphone sensitivity, frequency response, and the option to enable wind noise reduction. As with before, all the needed ports are easily found behind rubber covers on the right side of the body, with stereo microphones found in front of the camera's hotshoe.

The other noteworthy change to the D7200 would be the inclusion of Wi-Fi and NFC capabilities. Where the Nikon D7100 required the use of a Wu-1a adapter for wireless capabilities, the D7200 now offers it right out of the box.

Start taking pictures and you'll most feel the difference between the D7200 and the D7100. The internal buffer on the D7200 has been greatly increased, being able to take up to 18 shots in RAW (14-bit compressed) and 100 in JPEG compared to just six RAW and 50 JPEG shots with the D7100. That's a much more reasonable rate if you are looking to shoot sports and action, so this is very welcomed update.

Also improved, is autofocus performance. This looks to be a DX version of the autofocus module found in the recent D810 and D750 cameras, and has 15 cross-type sensors with 11 that are sensitive up to f/8. The focus points are now sensitive beyond -2 EV (to -3EV), while the central focus point is sensitive up to -3 EV. So you can now focus in conditions a full stop darker than what was possible with the D7100.

We put both of these to the test along with Nikon's new AF-S DX Nikkor 55-200mm f/4-5.6G ED VR II lens by trying capture some images of birds (mostly yellow-vented Bulbul's and Olive-backed Sunbirds). The combined autofocus speed of both lens and camera was just about adequate to keep up with our fast moving subjects, and the larger buffer of the D7200 certainly helped when we were shooting in Continuous High mode.

Taking the D7200 out for a shoot at the Gardens by the Bay later on also gave us a better idea of the color reproduction tendencies of the camera, as well as how the camera performed at higher ISOs. It seems the D7200 gives accurate color reproduction but has a slight tendency to underexpose by about half a stop, presumably to preserve highlight information.

Compared to the Canon 7D Mark II, the D7200 seemed to be slightly smaller and lighter. AF speeds seemed to be about even, but the 7D Mark II still has an advantage in terms of buffer size and continuous shooting rate. However, it does seem like images from the D7200 are slightly sharper straight out-of-camera, with a touch more contrast. The D7200 images also hold up better at higher ISO settings as Canon has a more aggressive noise reduction algorithm, removing noise at the expense of detail.

by *Marcus Wong*

TESTED & RATED

8.0/10

HWM SINGAPORE



TAP FOR GALLERY

CROSSING FITNESS WITH MUSIC

Jabra Sport Coach Wireless

AT A GLANCE

Connectivity
Bluetooth 4.0, A2DP & NFC

Battery
5 hours

Cable Length
60cm

Weight
16g

Price
$248



The Jabra Sport Coach Wireless works with its proprietary app, just as smoothly with other third-party fitness apps.

The Jabra Coach wireless headphones shares a few characteristics with the Jabra Pulse. The earbuds and ear tips are designed for high-intensity workouts, and they both allow great flexibility thanks to its wireless nature. The Pulse and Coach are different when it comes to their fitness goals – the Pulse tracks your heart rate with its built-in monitor, while the Coach provides tailored cross-training workout programs through the Jabra Sport Life app, topped off with a slew of generic tracking features for your textbook fitness junkie.

The Jabra Sport Coach Wireless's no-nonsense plastic and rubber combo is not exactly the sexiest surface you can conceive. To make things more cringe-inducing is the powder blue highlights (a color you won't associate a cardio-intense sport with) on the soft-gel earbuds against a drab grey shell and a wire that links both sides together. However, the Sport Coach's design helps to accentuate the sense of durability these they offer. With the help of the winged tips, it stays put in your ears; they can take a good trashing in perspiration and heat and not slip out of place. The buttons are easily accessible and nicely spaced apart, so it's unlikely you'd mis-click during your run.

While the cross training app is a very nice tool to have, the Jabra Sport Coach Wireless is not a perfect solution for the cross-training crowd. To begin with, it only provides instructions for the workouts on the app. The built-in gyroscope and accelerometer cannot actually track your movement during the static exercises, and the Jabra Coach device is nothing more than a button to indicate completion of each set. The timed programs are a little better – the timer starts, and you're given slight audio cues for starting and stopping each set. The onus is on you to actually do the exercise, of course.

While the features do boast being a great help for cross-training, we actually

PICTURES JABRA



These winged eargels are the reason why running is a fuss-free activity with these wireless earphones, and they come in different sizes.

CONCLUSION

The Sport Coach Wireless is great for exercise; the audio quality alone speaks for its price tag.

found the Jabra Coach's cardio-tracking combined with the Jabra Sport Life app to be its strongest suit. A short run tells us that the Coach's tracking is accurate and sensitive – for example, our test runner had a stable cadence and step, and it was reflected as such in the post-run screen with a graph that showed the level of consistency throughout the exercise. Our chosen track was one with varied elevation, and the app took it further by telling us the different points of elevation at the particular point in the lap and time. That is impressive for a pair of earphones. What we also liked was how it gave us the option to share our exercise on social media, but at our own free will – there's nothing to unlock or achieve and there's no hard-selling of extra features or over-sharing of activities on social platforms through the app.

Sport Coach's audio quality quite close to what you'd expect for a Bluetooth headphone of its price point, even when you ignore the fitness features. The sound signature plays nicely with workout tracks – unapologetically bass-heavy, with robust middle frequencies that makes percussion and deeper vocals sound clean and clear. Venture beyond, however, and the Coach's limits will start to show; higher frequencies found in synth or effects begin to creak. Then again, anyone who uses the Coach should be paying full attention to their core muscles with the latest popular songs or club-workout mix - not piling calories with beer and a jazz or soul album on repeat. With that said, the Coach can certainly hold its own as your everyday earphone.

Connectivity-wise, the Coach is almost great. It does cut off very briefly during a run for reasons unknown, but you'd barely notice the skip in audio since the connection resumes almost instantly. A smart guess would be how the earphones struggle to stay stable while your head jostles the buds when on the road. One poor habit of the Jabra Sport Coach Wireless is how it doesn't 'remember' your paired phone – every time you power the ear-buds on, it doesn't hop on to your already-searching phone. It's as annoying as the guy at work who always forgets your name despite seeing you day in and out. Fortunately, the re-connection process takes mere seconds, so that shouldn't hinder your workout or listening routine.

by *Liu Hongzuo*

TESTED & RATED

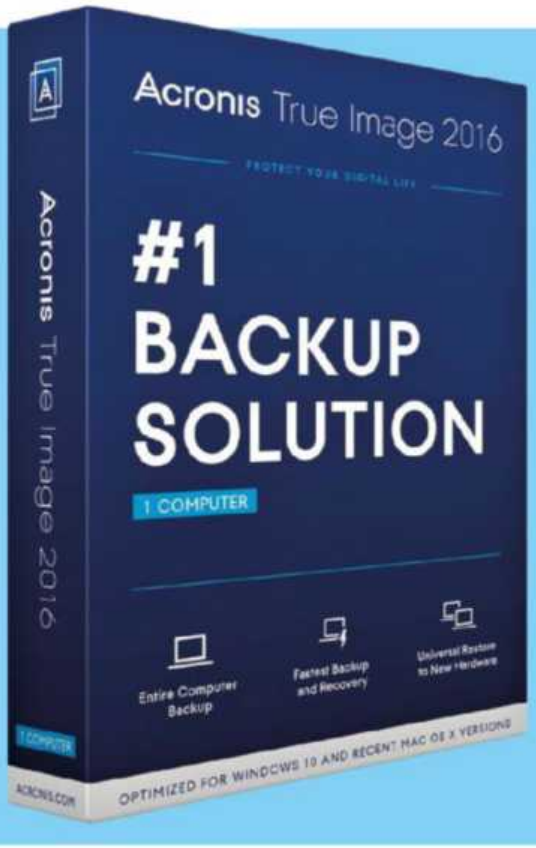
8.0/10

HWM SINGAPORE









MULTIPLE USERS, MULTIPLE DEVICES

Acronis True Image Cloud

AT A GLANCE

OS
PC & Mac

System requirements
For PC: 1GHz Intel Pentium processor, 1GB RAM, 1.5GB of free space, Windows XP SP3 or newer (except Windows Vista)

For Mac: OS X Mountain Lion 10.8.5 or newer

Price
$139.99/year (1 PC + 3 mobile devices)



An Acronis Archive folder appears as a virtual mounted drive for you to access your archived files.

Acronis True Image Cloud is the data backup company's take on what consumers in a rapidly evolving tech landscape will need going into 2016. While True Image 2015 provided key features like disk cloning, backup, and recovery, this latest iteration adds new functions that make it much easier to back up your stuff in a time when most of us probably own multiple devices.

These can be broken down into three core features – mobile device backup, the ability to manage multiple devices and users, and personal cloud archiving. Our PCs are no longer the sole receptacles of important data as phones and tablets are quickly becoming repositories of things like photos and contacts. And as our workforce becomes increasingly mobile, growing numbers of users are also storing work-related data on their mobile devices.

As a result, we're happy to see that Acronis has picked up on this trend and extended its cloud backup services to iOS and Android mobile devices. The mobile interface replicates the clean, tabbed interface of the desktop version. Making a backup is simple – hitting the "Backup" tab brings up a menu for you to select what you'd like to backup (photos, contacts, messages, calendars, videos). How does this compare to a free service like Google Photos? For one, you have access to unlimited cloud storage and can store photos in their original resolution.

So if you do get a new phone – or lose your current one – you'll be able to easily recover all the data from your old device. Unfortunately, you can't backup messages on iOS devices yet, but we wouldn't be surprised if the feature is added later.

The Online Dashboard allows you to view and manage all your devices from one place. The dashboard opens up in the web browser, and we were able to view the status of individual backups from various devices and see which devices were online. There are also quick options to initiate data recovery and manage just how you want to do your backups. This includes fine-grained control over things like what to backup, the backup location (Acronis Cloud, an external hard drive, or even your own FTP server), and when to

PICTURES **ACRONIS**



The Online Dashboard allows you to manage all backups of all your PCs and mobile devices from a single interface.

CONCLUSION

Improves on its predecessor with a slew of new features for securing and managing data across multiple devices and platforms.

perform a backup.

The archiving feature is also really useful, even if it may not appear to contribute to data security at first glance. It essentially analyzes your drive and categorizes files according to their type, age and size. You can then select which files to move to Acronis Cloud, freeing up disk space in the process. Archived files are deleted from your physical drive, so this will come in handy when dealing with large, rarely accessed files like old movies and large song libraries. Once the process is complete, an Acronis Archive folder will appear as a mounted virtual drive, so you'll still have access to archived files.

According to Acronis, it has also made some tweaks to the way files are synced to the cloud in order to improve performance. It now supports parallel data streams, which should increase overall bandwidth when compared to the single stream available to the 2015 version of the software. Of course, your mileage may vary as backup speeds depend very much on your Internet connection. On a wireless 1Gbps fiber broadband connection, we took about 15 minutes to complete a backup of approximately 50GB of data. You also have the option to set the priority level of the backup, depending on how fast you'd like it completed. Of course, a high priority level will come at the expense of bandwidth for other network connections.

In addition, an old feature returns on True Image's latest iteration. It's called "Try&Decide", and it does exactly what it sounds like it does. It creates a secure partition on your system drive where you can install untrusted software or perform risky operations without compromising your system or data. For instance, if you're unsure if a certain driver or email attachment is safe, you can enter Try mode to test it out.

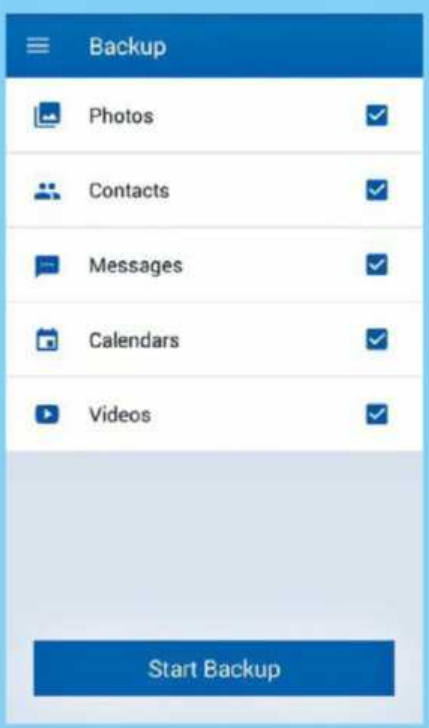
This mode persists across system reboots, so if an unstable program causes your system to restart, you'll have the option at the next boot to discard the changes that caused the crash. It all felt relatively hassle-free, and it certainly couldn't have been released at a better time. Given the reports of instabilities and driver conflicts surrounding Windows 10, this feature should find favor with early adopters who may want to see how a certain update plays with their OS before committing to it. One caveat – this feature does have a performance impact, so that's one thing to take note of if you have a slower machine. However, there is no price on peace of mind.

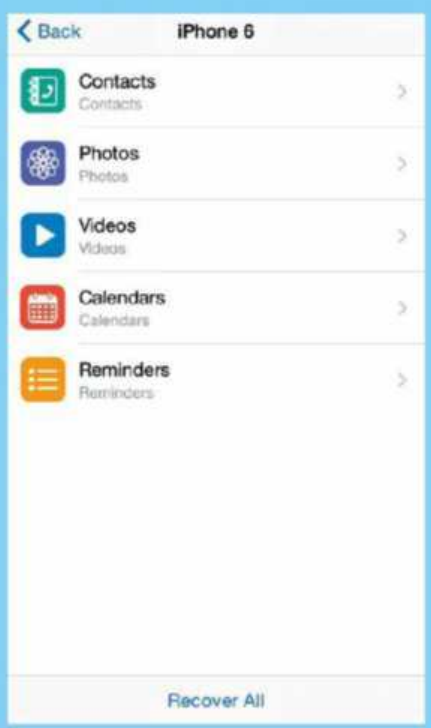
by *Koh Wanzi*

TESTED & RATED

9.0/10

HWM SINGAPORE







IN-CAR ENTERTAINER

Pioneer AVH-8750BT

AT A GLANCE

DIN size
2-DIN

Display
7-inch 800 x 480 pixels

Smartphone support
Apple CarPlay, Android Auto

Price
$1,099



The AVH-X8750BT is one of the ways you can get Apple CarPlay in your car.

CONCLUSION

The Pioneer AVH-X8750BT may be pricey, but its wide breadth of abilities makes it one of the best in-car receivers around.

TESTED & RATED

9.0/10

HWM SINGAPORE

The AVH-X8750BT is Pioneer's latest flagship in-car multimedia receiver and it comes in a double-DIN package with a large 7-inch clear-type resistive touchscreen display that serves up a resolution of 800 x 480 pixels. Though this might not sound like much, it is sharp enough for driving use. Additionally, the display is bright and vibrant, even under harsh sunlight. Sensitivity to input was also good. The front display panel is fully detachable, helpful when parking in dodgy neighborhoods.

As a flagship receiver, it is chok-full of features and the ones worth highlighting is support for both Apple CarPlay and Android Auto. This makes the AVH-X8750BT one of the few aftermarket solutions that's cross platform compatible. However, users can only use Apple CarPlay for now since Android Auto is not officially available in Singapore yet.

That aside, the AVH-X8750BT also supports Pioneer's own AppRadio mode. AppRadio allows the AVH-X8750BT to harness the power and connectivity of your smartphone to power apps such as navigation, web browsing and music and video playback. Apps that are on your smartphone will automatically appear in AppRadio if they are compatible. Some compatible apps include Waze and Parkopedia.

Speaking of playback, the AVH-X8750BT supports a wide variety of file types and formats including high-resolution FLAC audio (up to 24-bit/192kHz), plus popular video formats including MKV, DivX, WMV and more. Also impressive is that it can play these media files from a wide range of sources including your mobile device, SD card, USB flash drive and even CD or DVD.

On the audio front, the AVH-X8750BT has three RCA high voltage pre-outs, so it can be connected to speakers, subwoofers or even additional amplifiers. Users can also tweak the sound signature to their liking using the 13-band graphic equalizer which can be found in the device's audio settings menu.

One particularly nifty feature is called Time Alignment, which solves the problem of the speakers being located at different distances from the driver. What Time Alignment does is that it adjusts the timings of the speaker so that sound from each speaker in the car reaches the driver in perfect synchrony. Users can also tweak the listening position to project the sound to different areas of the car.

And for drivers who face difficulties parking, the AVH-X8750BT also accepts dual video camera inputs, allowing it to show video feeds from two camera sources. Unfortunately, it can't record footage.

Though the AVH-X8750BT is pricey for an in-car multimedia receiver, it's a worthwhile investment if you're a geek that also spends an inordinate amount of time in your car.

by *Kenny Yeo*



PICTURES PIONEER

FEATURE

A JOURNEY THROUGH TIME

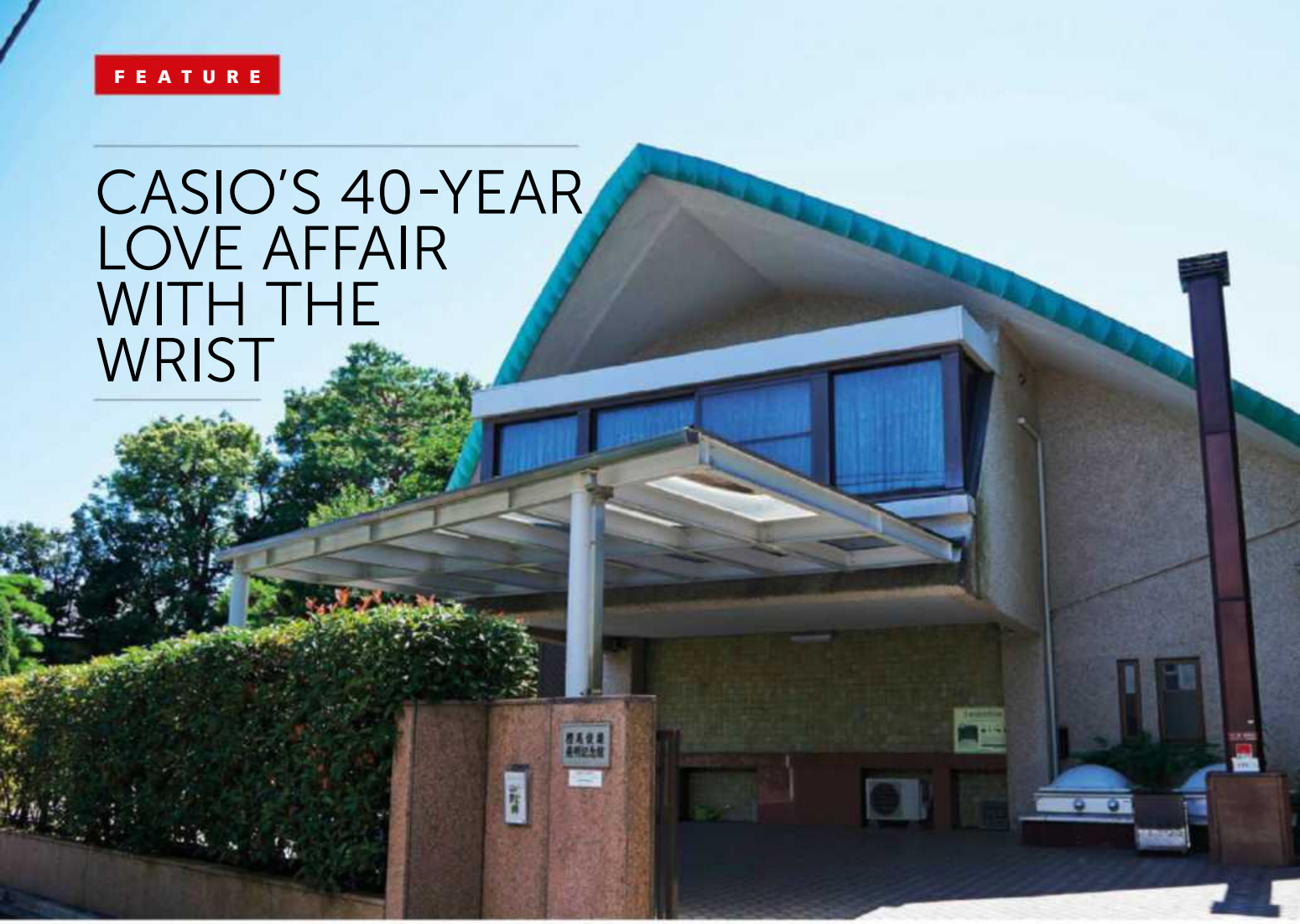
In 1974, Casio introduced their very first digital wristwatch, the CASIOTRON. It featured CMOS LSI technology developed from its successful electronic calculators, to provide automatic calendar functionality. As a computerized feature, you could technically call the CASIOTRON a "smart" watch. For the next 30 years, Casio would develop dozens of multifunctional digital watches that can all be considered the true forefathers of the modern smartwatch.

Text by *Zachary Chan*



PICTURE CASIO

CASIO'S 40-YEAR LOVE AFFAIR WITH THE WRIST



From Smart Watch

To fully appreciate the rich, colorful and often quirky inventions that Casio cooked up over the years, HWM visited the Toshio Kashio Memorial Museum of Invention in Tokyo, Japan. This is essentially the actual mansion of Casio's inventor-founder converted into a museum showcasing his achievements from the 14-A, the world's first compact all-electric calculator that started it all to the watches and musical instruments that Casio is known for today.

You see, Casio's love of the wrist wasn't about artisan craftsmanship, status symbols or high society, at least not in the way of the Swiss. Casio's digital endeavors were a measure of Japanese ingenuity. Casio has always believed that the wrist is the best place to wear an information device, and time is merely another piece of information. So when the company embarked on a journey to develop digital watches, they didn't just display time and date, but a host of other data too.

These watches were designed for the masses, to cater to the needs of business, travel, sports and even leisure. If you are a 70s or 80s child, you most probably have owned a Casio calculator watch. If you're not, perhaps your parents still have one, tucked away somewhere. While Casio wasn't the first company to produce a calculator watch, they improved upon it with the CD-40 which included built-in memory to store phone numbers. This would spawn the highly popular Databank series of watches that soon would feature more functions from timetables to autodialing, multi-language displays and even a dictionary, essentially akin to having a PDA on your wrist.

> "Casio's love of the wrist wasn't about artisan craftsmanship, status symbols or high society, at least not in the way of the Swiss. Casio's digital endeavors were a measure of Japanese ingenuity."

Outside the successful Databank series Casio produced dozens of other multifunction watches which, while lesser known, were all ahead of their time. Think of any feature that's been touted by a modern wearable or smartwatch—yes, even the Apple Watch—and we would probably be able to find a model in Casio's archives that already had that functionality 10-, 20-, even 30-years ago. Go on, try us.

Before fitness trackers, Casio had watches with a pedometer (JC-11), pulse rate (JP-100), blood pressure (BP-100) and calorie counter (FBR-10W); before Apple Pay, Casio experimented with a digital wallet function on a watch (GWS-900); before Google Maps, Casio had a map charting watch you physically roll along an actual map to find the distance between two points (MAP-100). Want something quirkier? Before the advent of apps, Casio had a special digital compass watch (CPW-100) called the prayer compass for Islamic travelers to determine Qibla direction and daily prayer times. They even had a watch that could aid in performing magic tricks (MGC-10).

In 1999, the Casio PRT-1 was the world's first watch with a built-in GPS sensor. In 2000, Casio produced two more world's firsts, the WMP-1V MP3 watch and the WQV-1 camera watch.

To Smartwatch

So, if Casio has been such a great innovator in the space of digital watches, just what happened to them? Why have they not ridden

PICTURES CASIO

in and led the way on the whole wearable phenomenon on a shining white horse? How is Casio only known today for their G-Shocks?

Somewhere towards the late 1990s, there was a massive boom for the G-Shock line while sales of multifunctional digital watches stagnated. Try as they may, Casio couldn't get past a 70 billion Yen sales wall while G-Shocks became their prime seller. In fact, Casio reached an all-time high for their watch business in the 2014 financial year with 153 billion Yen in sales, with a projection to hit 200 billion Yen sales by 2018 largely due to G-Shocks.

"Casio reached their highest sales ever for their watch business in the 2014 financial year at 153 billion Yen, with a projection to hit 200 billion Yen sales by 2018 largely due to G-Shocks."

According to Yuichi Masuda, Senior Executive Managing Officer and Timepiece Division Manager, Casio's strategy shift around 2004 from digital multifunction to analog was due to the increasing need and complexity of adding new functions into their digital watches, which made operations complicated. The limits of technology also had a detrimental effect on product design: basically, watches got ugly real fast.

The boom in G-Shocks allowed Casio to focus on what they now term as Intelligent Analog design, where analog watches inherit digital technologies with the aim of improving functionality rather than just adding unnecessary features. From Triple Sensor to GPS Hybrid Wave Ceptor and Tough Solar technologies, the lessons from this intelligent analog design that Casio has perfected from their shift over the last decade are miniaturization and energy efficiency.



The CASIOTRON digital computerized watch that started it all in 1974.



The Casio Databank Telememo CD-40 could store your phonebook in your wrist. It sold 6 million units in 5 years since its launch in 1984.



PICTURES **CASIO**



And yet, in an interview with The Wall Street Journal in July, new company President Kazuhiro Kashio let it slip that Casio is once again looking towards digital and are actually developing a smartwatch.

Of course, Casio's entry should be no surprise as the wearables market shows no sign of abating. Our little trip to Japan and this history lesson in digital watch design would also have little impact if there was no follow up. Even the Swiss are entering the fray, so for Casio to remain silent would be a folly indeed.

"New company President Kazuhiro Kashio let it slip that Casio is once again looking towards digital and are actually developing a smartwatch."

Whether it will take form in the digital roots of Casio's past or the intelligent analog of present day G-Shocks remain to be seen, but after extensively using just about every major smartwatch since the Pebble to the Apple Watch, I have realized that no one has yet to get the formula right.

Are we excited for the prospect of a new Casio smartwatch? We'd be lying if we say we weren't. If there is any company that can claim to have the chops to make the smartwatch concept work, Casio will be at the very top of the list.

My personal requirement for what I'd consider an entry into the smartwatch market is that it has to be a watch first, with customizable notification functionality, and fully powered via solar. Sounds simple enough? Then why hasn't anyone made it yet? Well, here's looking at you Casio. HWM



The WQV-1 launched in 2000 was the world's first watch with a built-in camera. Its successors, the WQV-3 and WQV-10 could shoot in color.



The first G-Shock watch, DW-5000C, was released in 1983. By late 1990s, G-Shocks would overshadow all other Casio multifunction watches.

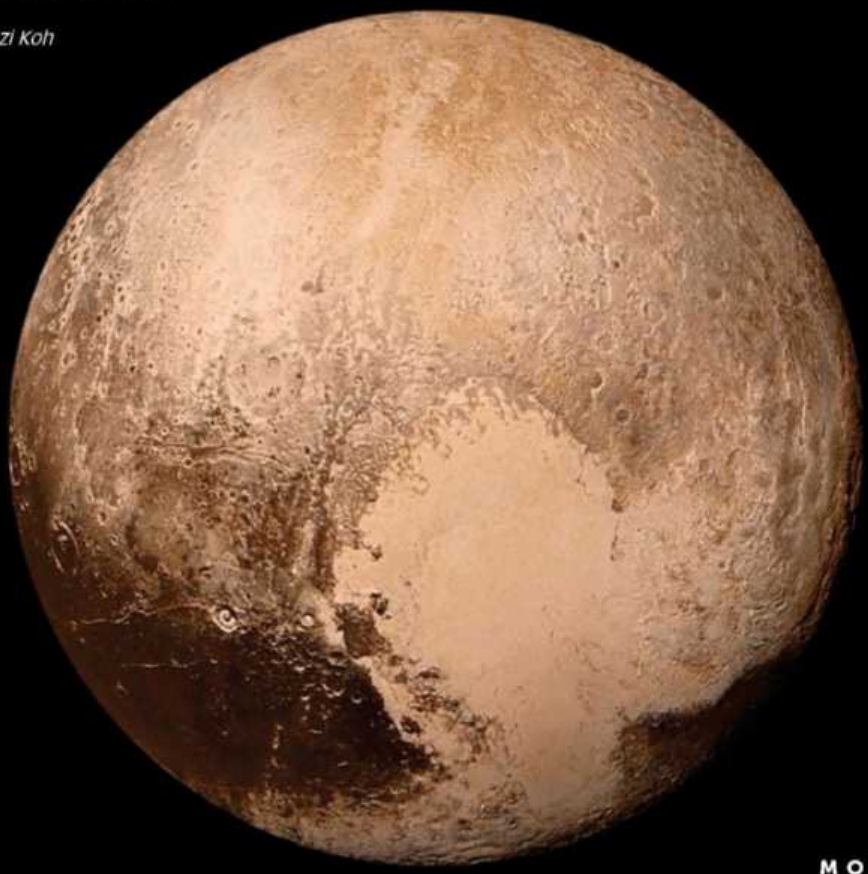
PICTURES CASIO

LEARN

NEW HORIZONS: REACHING PLUTO

Pluto has been our Solar System's last holdout. Even though it was first discovered back in 1930 by Clyde Tombaugh, a glimpse of the former planet turned dwarf planet has eluded us. That is, until NASA's New Horizons craft swung by the icy star back in July and beamed back the first ever images. Here's how it was done.

Text by *Wanzi Koh*



PICTURE NASA

MORE INSIDE>
- APPLE CARPLAY AND YOU
- FAST CHARGING TECH EXPLAINED
- WHY NOT ALL 4K TVS ARE THE SAME

A CAMERA IN SPACE:

All about how far we'd go to take a picture of a rock.

by *Koh Wanzi*

New Horizons' successful flyby is significant not just because of the information it returned about Pluto, but because it closes a chapter in mankind's exploration of the immediate Solar System. Mariner 2 conducted a flyby of Venus in 1962, and other probes have been sent to farther planets in succeeding decades. Pluto was the only one that remained out of reach, but through the New Horizons spacecraft, we've finally visited all our planetary neighbors.

Here's a look at some of the salient points of the nine-year mission.

A LONG, URGENT VOYAGE

New Horizons blasted off from Cape Canaveral Air Force Station on 19 January, 2006, aboard an Atlas V 551 launch vehicle. It achieved a launch velocity of 58,536 km/h, making it the fastest craft to ever leave Earth's orbit. As it turns out, astronomers were in something of a hurry to reach Pluto.

To the untrained eye, the cosmos may appear immutable and unchanging. But Pluto has actually been moving farther away from the Sun since 1989, which means it's getting less heat each year, a big deal for an already cold planet. Astronomers think that this could cause the atmosphere to freeze and descend to the ground, so they had to get there in time to study the thicker atmosphere while it was actually still in the air.

Furthermore, it was important to map as much of Pluto and its moon, Charon, as possible. Just as the Arctic Circle on Earth experiences six-month stretches of day and night, parts of Pluto and Charon remain shrouded in darkness for entire decades. And as Pluto moves farther away, increasing sections of both bodies will recede into shadow, making it difficult for New Horizons to capture pictures of their surfaces.

PICTURE NASA

GRAVITY THIEF

In order to get to Pluto as quickly as possible, the team behind New Horizons planned to swing by Jupiter for something called a gravity assist maneuver. For the first 13 months after launch, New Horizons was busy performing a series of instrument checks and calibrations, small trajectory corrections, and rehearsals for the scheduled encounter with Jupiter.

That happened on 28 February 2007, when the craft swung by the gas giant, dipped into a gravity well and absorbed some of Jupiter's orbital energy to propel itself back out even faster. This added over 14,000km/h to its speed, enabling it to shave three years off its journey. And at a distance of 2.3 million kilometers from Jupiter, it was also the closest a spacecraft has ever come within the planet.

CRUISE AND SNOOZE

From 2007 to 2014, New Horizons spent the majority of the time in a state of hibernation, signaling once a week to the team on Earth that all was well. However, it was roused from its slumber for about 50 days a year to perform a series of instrument checks and navigation measurements to ensure that it remained on the correct course.

While most spacecraft rely on solar energy to power their onboard systems, New Horizons' journey into the outer reaches of the Solar System meant that this won't be very feasible. Instead, it gets its power from 11kg of plutonium dioxide, which can last until the late 2020s or beyond.

Electrical power is generated from a single radioisotope thermoelectric generator (RTG), which converts the heat generated from the natural radioactive decay of the plutonium dioxide fuel into electricity.

THE GOD OF THE UNDERWORLD HAS A HEART

On July 14 2015, New Horizons performed the first-ever flyby of the icy dwarf, coming within 12,500km of its surface. This was the culmination of a set of intensive preparations, which began when the craft woke from its hibernation in December 2014.

One of the most striking images came about by combining four images from New Horizons' Long Range Reconnaissance Imager (LORRI) with color data from the Ralph visible and infrared spectrometer to create an enhanced global color view.

At the center of the "heart" is an icy plain that has been dubbed Sputnik Planum. This region shows no impact craters, whereas other regions are peppered with them. The crater-marked regions suggest far greater age than the smooth ones, indicative of a complex geological history.

FAST CHARGING EXPLAINED

by *James Lu*

As smartphone displays have grown in size and resolution, so too has battery capacity to meet the increased power draw. Unfortunately, battery life still struggles to accommodate the needs of heavy-usage smartphone users and, as such, reducing re-charge times has become the next best thing. Over the past few years, a number of companies have introduced innovative technologies that speed up the charging process.

HOW CHARGERS WORK

How fast a battery charges is determined by how much power it receives from the power source (normally a wall outlet), through the charger, to your phone. Your phone also includes built-in regulators to prevent pumping too much power into the battery and frying it. The actual amount of power output from the charger is determined by the voltage (measured in volts) and current (measured in amps) that it is rated for safe use.

Not all chargers output the same volts and amps. A standard phone charger will output around 1A at 5V for a total of 5W of power. If you charge your phone by connecting it to a USB port on your laptop, you're looking at 0.5A at 5V for 2.5W of power on a USB 2.0 port, or 0.9A at 5V for 4.5W of power on a USB 3.0 port, which basically means that if your phone can handle anything above 0.9 amps (it almost certainly can), a USB port will charge it more slowly than the charger that came with the device.

Now let's take a look at some of the fast charging technology available today.

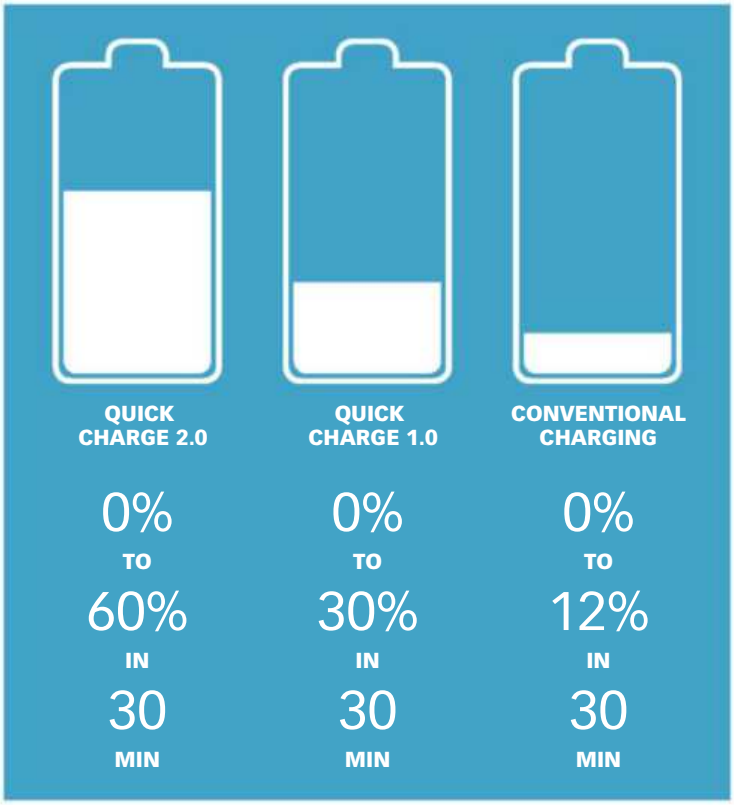


QUALCOMM QUICK CHARGE

The most prevalent fast charging technology available today is Qualcomm's Quick Charge. Qualcomm's technology is designed to maximize charging efficiency by delivering a higher power load. Quick Charge 1.0 made use of a 2A/5V charger, resulting in 10W of charging power, which is double the conventional 1A/5V chargers. Obviously, only phones with higher internal regulators were able to make use of Quick Charge 1.0, and you could find it on the Samsung Galaxy S III, LG Nexus 4 and Optimus G, and Xiaomi Redmi 2, as well as a few others. As far as more recent devices are concerned, the Xiaomi Mi 4i still uses Quick Charge 1.0.

In 2013, Qualcomm introduced Quick Charge 2.0 on Snapdragon 800 chipsets, which allows for an even higher level of power transfer between your power source and device. There are actually three different specifications of Quick Charge 2.0 chargers: 3A/5V, 1.67A/9V, and 1.25A/12V. However all three deliver 15W of power.

Plenty of the latest devices support Quick Charge 2.0 including the LG G4 and G Flex 2, HTC One M9, Samsung Galaxy Note 4 and Galaxy Note Edge, Sony Xperia Z3 and Z3 Compact, and Xiaomi Mi 4. However, out of all the phones listed, only the Samsung and Xiaomi phones include a Quick Charge 2.0 charger in the box. If you do end up buying a Quick Charge 2.0 charger, do note that all devices compatible with the Quick Charge 2.0 standard can safely use any Quick Charge 2.0 compatible charger - the technology inside them is the same. Don't be fooled into buying an expensive branded one that matches your phone brand, as it won't charge any faster.



PICTURES OPPO, SAMSUNG, ASUS ILLUSTRATIONS IANCHONG

SAMSUNG ADAPTIVE FAST CHARGE

Samsung's Fast Charge technology, found in the Galaxy S6 and S6 Edge appears to be exactly the same as Qualcomm's Quick Charge 2.0 technology. The charger that ships with both the Galaxy S6 and S6 Edge is rated to the exact same 1.67A/9V specifications as Qualcomm's Quick Charge 2.0 chargers. We also tested the S6 with the charger supplied with the Galaxy Note Edge, and it appears to work just fine. It's possible that Samsung simply modified Qualcomm's technology and adapted it to work with its own Exynos chips.



ASUS BOOSTMASTER TECHNOLOGY

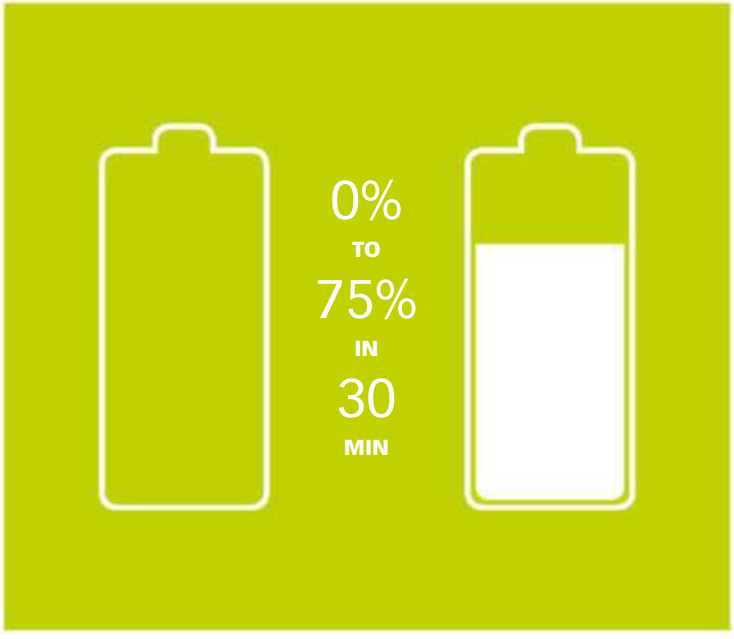
ASUS' BoostMaster technology, found in its ZenFone 2 series of phones, also appears to use a similar technology to Qualcomm's Quick Charge 2.0. The charger supplied with the phone is rated at 2A/9V, supplying a maximum of 18W of power. Despite using an Intel Atom processor, the ZenFone 2 will also fast charge using a Qualcomm Quick Charge 2.0 charger or even a Samsung Adaptive Fast Charger.



OPPO VOOC FLASH CHARGE

While Oppo uses Qualcomm's chips in its phones, it has its own quick charging innovation that's quite unique. It's called VOOC Flash Charging, which stands for Voltage Open Loop Multi-Step Constant-Current Charging.

While VOOC chargers also deliver a higher power load than standard chargers - the current second generation VOOC mini chargers deliver 5A/5V for a whopping 25W of power - Oppo also uses a different battery structure in each of its phones. VOOC-enabled phones consist of several individual battery cells, and the high 5A current is split among those. Due to this, the battery has a higher number of contacts than usual, with each cell charged simultaneously. Most of Oppo's latest smartphones are VOOC compatible, including the Oppo N3, R5 and Mirror 3. All VOOC-enabled Oppo phones come with a compatible charger in the box.



AN INTRODUCTION TO APPLE CARPLAY

All the important things you need to know to get that Apple experience in your car.

by *Kenny Yeo*

Fact #1: The iPhone is one of the most popular phones in the world. Since its launch in 2007, Apple has sold over 700 million of them. And in 2015, nearly one out of every five smartphone sold is an iPhone. Fact #2: People spend a lot of time in their cars. A report by Time Magazine last year mentioned that the average driver in Los Angeles spends about 90 hours in his car. That's more than a whole week.

How do you make these 90 hours more bearable? Apple's solution is CarPlay, a way for drivers to make use of their iPhones in the car. It takes all the important tools of the iPhone and puts them on a car's built-in display.

HOW I GET CARPLAY IN MY CAR?

First, you need to make sure you have at least an iPhone 5, and that it is running the latest version of iOS. CarPlay functionality for Singapore was only added after iOS 8.3.

Now, there are two ways to get CarPlay. If you are shopping for a new car, make sure it is a model from one of the auto manufacturers that have committed to support CarPlay. To date, these actually include most major brands such as BMW, Ford, Honda, Hyundai, Kia, Volkswagen, Audi, Nissan, Mitsubishi, Mazda, Mercedes-Benz and Ferrari. Here's a little piece of trivia: the first car to include support for CarPlay out of the factory was the Ferrari FF.

Now, for drivers who already have their own vehicle, you can get CarPlay by investing in an aftermarket in-car multimedia receiver. To date, in-car entertainment specialists Pioneer, Alpine and Kenwood have all released receivers that support CarPlay.

These in-car multimedia receivers are worthwhile investments especially if you only have a basic one in your vehicle right now as they offer a lot more functionality besides just CarPlay. These receivers can often play multiple file formats including high-resolution audio and even videos. If you are considering installing displays for passengers in the rear seats, these high-end receivers can help you do that too.



THE HOME SCREEN

Once you have the appropriate in-car multimedia receiver, simply plug your iPhone in using the Lightning Connector cable and CarPlay should launch automatically on the receiver's screen. The main menu is highly similar to that of iOS. There are large icons indicating phone functions, music, maps and messages. The interface has been purposefully designed to be highly legible and easy to navigate so as to reduce distraction. The apps that you see are mostly native Apple apps that have been optimized for CarPlay. There are only a handful third-party apps that works with CarPlay right now, with the most prominent one being Spotify.

From the Home Screen, you can tap on the icons to access them as you would on your iPhone or iPad. You can also make use of Siri, which actually plays a big part of CarPlay. It represents the least intrusive, and safest way as a driver to interact with CarPlay. In fact, most aftermarket in-car multimedia receivers that support CarPlay will include a microphone to let Siri work better. Most of these receivers will let drivers reconfigure their steering wheel controls to allow for quick activation of Siri. And if your car has knobs or controllers that are used to control the car's native multimedia system, you can use those too to control CarPlay.



PICTURES APPLE & PIONEER

PHONE

Naturally, the Phone app lets you take calls. And you can select from the usual "Favorites", "Recents" or "Contacts". It's easy to select an individual from your contacts because there's an option to the left that allows you to browse alphabetically. It's definitely a very well thought out feature. There's also a keypad option for drivers to input the numbers directly.

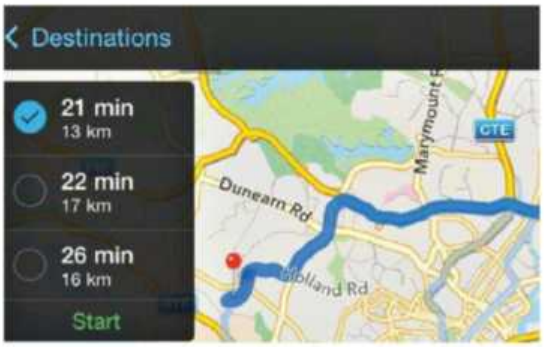


MAPS

Apple Maps is the only navigation application on CarPlay and it works mostly just like Maps on your iOS device. One thing to note is that you cannot pinch to zoom in or out. Instead, there are dedicated zoom in and zoom out buttons for that. This is to make sure drivers do not inadvertently zoom in on the wrong spot on the maps.

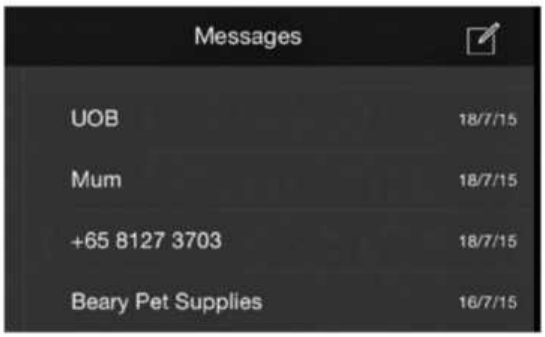
In the top right corner you will see the heading "Destinations". Inside, you will find the most recently searched for addresses. And thanks to the close integration of Mac OS X and iOS, you can even search for addressed on your Mac and send it over to your iPhone so that it shows up on CarPlay. Of course, you can also search for locations either through the touchscreen or Siri.

Like any decent standalone GPS navigation device, Maps will offer up to three alternatives when requesting for a route. And as you drive along, it will prompt you of a turn approaching or an exit on the highway.



MESSAGES

Apple places a great emphasis on safety. To ensure drivers do not get distracted by text messages, the Messages app never displays your messages in full. Instead, it only shows the most recent senders, and tapping on them will activate Siri to read out the messages for you. Likewise, while CarPlay allows drivers to send messages, they must be dictated through Siri. There's no onscreen keyboard option, but also no option to send preset messages. As a result, Messages can be frustrating to use especially if Siri cannot understand you properly.



ENTERTAINMENT - MUSIC, AUDIOBOOKS, PODCASTS

The Music app is where you find and play all your music in your car. All the tracks that you have copied over to your iPhone will show up here. It's quite easy to navigate as there is always the option to list them alphabetically. Alternatively, you could also use Siri. e.g., if you have music from Elton John in your iPhone, just activate Siri and say, "Play tracks from Elton John."

If you are an Apple Music subscriber, you can also stream music over CarPlay. However, Apple Music functionality is not so well implemented. The only viewable option is Radio, which shows you your most recently played radio stations on Apple Music. That said, you can get Apple Music to work via Siri too, so a command like "Play top hits from Mariah Carey" will all work.

Tapping on Audiobooks lists all the audiobooks that you have downloaded on your iPhone. Unfortunately that's all there is to it, you cannot browse, download or purchase new ones. The Podcast app is much more useful. Apart from showing your downloaded Podcasts, you can also browse through popular podcasts. Again, to minimize distraction, CarPlay will only play audio even for video podcasts.



DEMOCRATIZING SSD STORAGE



SSDs have never been more affordable and here are the factors that have been helping drive prices down.

by *Kenny Yeo*

As little as three years ago, a high-end 256GB SSD can set you back as much as $500. Today, a typical high-end SSD of the same capacity costs less than half that amount. It's amazing how much prices of SSDs have fallen. Of course, one of the reasons for that is because of volume production. Economies of scale mean that prices fall as production ramps up. But beyond this, there are also other factors at play including more efficient manufacturing processes and increased competition in form of third-party controllers.

When talking about more efficient manufacturing process, what we are really saying is that each wafer now gives us more NAND dies. This is achieved by shrinking the manufacturing process so that the NAND dies get smaller. At the present, we are looking at sub-20nm manufacturing processes. Toshiba's latest MLC NAND is currently being produced using a 15nm manufacturing process, while Micron recently announced that it will begin production using a 16nm manufacturing process.

Unfortunately, we are fast approaching the limits of what can be achieved with shrinking manufacturing processes. To put it plainly, reducing the manufacturing process means squeezing more cells onto the die, which in turn means there is less space between each cell. And since each cell has to hold a charge, the interference from neighboring cells can sometimes disrupt or even inadvertently change the state of the cell that is next to it and cause the data to become corrupt. What this ultimately means is that there is a limit to how close cells can be put next to each other.

NAND manufacturers overcome this problem by increasing the amount of data that can be stored in a single cell. Imagine that you have 10 baskets and instead of holding a single ball each, they can now accommodate two balls each. You effectively double your storage. The idea applies to NAND memory too, though not quite so literally.

Early NAND flash was known as SLC NAND (single-level cell) as each cell held only a single bit of data. MLC NAND, which is the most commonly used type of NAND in consumer SSDs, typically refers to NAND chips with cells that hold two bits of data. Now, more SSD manufacturers are turning to TLC NAND (triple-Level cell), which stores up to three bits of data.

The next breakthrough in NAND technology is 3D Vertical NAND, but this technology is still very much in its infancy even though early products employing 3D Vertical NAND have been promising. As a result, TLC NAND will be, for the foreseeable future at least, the champion for driving prices of consumer SSDs down.

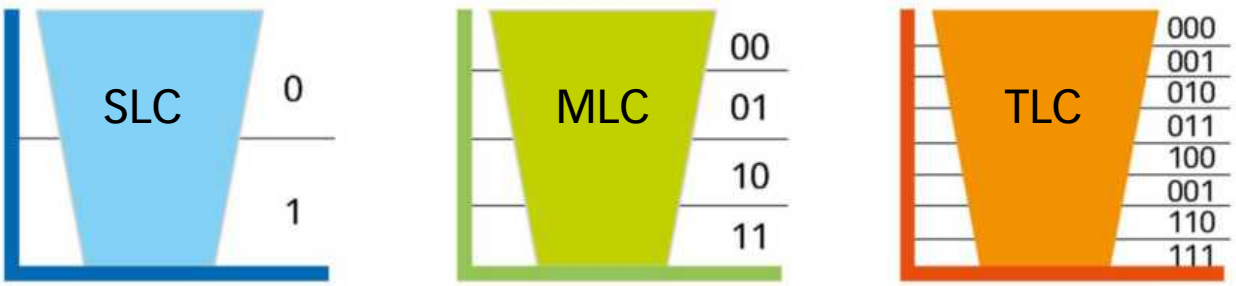
To be sure, TLC NAND is not a recent development. USB flash drives, as early as 2008, have employed the use of TLC NAND. However, endurance of these early NAND was poor and could not withstand the rigors of being used as a system drive. It is only recently in 2013 that Samsung put out the first consumer TLC NAND SSD - the SSD 840 Evo. And they were able to do so because of two things. The first is of course endurance of the dies itself are much better. Secondly, controller and firmware technology have both matured to the point where they could offer compelling enough performance and endurance.

In those early days, only Samsung had access to a controller capable of accommodating TLC NAND. One must realize that adding controller support for TLC NAND is much more complicated than just accommodating that extra bit of data per cell. The ECC engine (Error-correcting code) needs to be far more robust to deal with the more frequent and severe errors that TLC NAND drives would face. And Samsung was able to do so because it is one of the few SSD manufacturers that is manufactures its own NAND, develops its own controller and firmware.

Fortunately, the controller landscape has changed significantly. SanDisk and OCZ have both TLC NAND SSDs in the market. But more importantly, JMicron, Silicon Motion and Phison, have all announced new controllers in the past year that will offer support for TLC NAND and even 3D Vertical NAND. What this means is that smaller SSD manufacturers without the resources to develop their own controllers and firmware will now be able to source for controllers that can accommodate TLC NAND, allowing them to offer their own TLC NAND SSDs.

Obviously, such an arrangement does not promote much differentiation in terms of performance, but the increased competition is good for consumer as it can only drive prices down, especially in a market as price sensitive as SSDs. Without their own NAND production facilities, controller or firmware, these brands are really competing on price and whatever additional perks they can throw in, such as extended warranties or accessories. These will ultimately benefit consumers.

In summary, consumers can expect TLC NAND to be the driving force behind declining SSD prices. On top of that, the proliferation of TLC NAND SSDs will be aided by the greater availability of third-party controller offering support for such NAND memory. Here's to more affordable SSDs!



For a very generic explanation - think of the different types of NAND as glasses of water. For SLC NAND, there are only two voltage states, so it's easy to tell whether the level of water inside amounts to a "0" or "1". TLC NAND has eight voltages stages, allowing it to pack more data in the same space. However, it gets hard to tell at a glance where the water level is up to, which is why the trade-off is poorer performance. With better measuring and control techniques, this is minimized.

CONTROLLER TRIUMVIRATE

PHISON PS3110-S10
A quad-core controller that is designed for use in high-end enthusiast-class SSDs. It has an eight-channel design and claims to enable sequential read and write speeds of 550MB/s and 530MB/s respectively for SSDs using MLC NAND. Random read and write performance is claimed to be in the region of 100,000 and 90,000 IOPs respectively. Such performance figures are comparable to the latest high-end SSDs in the market today. The Phison PS3110-S10 will also offer hardware AES encryption.

SILICON MOTION SM2256
The latest controller from Silicon Motion is an improvement over the existing SM2246EN controller already used in some drives today. The SM2256 adds support for TLC NAND and features Silicon Motion's NANDXtend error-correcting code technology that claims to be able to improve the endurance of TLC NAND. It can also be extended to accommodate 3D Vertical NAND in future. Like most modern controllers, AES encryption comes as standard and the controller claims to be able to offer sequential read and write speeds of up to 540MB/s and 480MB/s respectively, meaning it is comparable with today's mainstream SSDs.

JMICRON JMF680
The JMicron JMF680 is an update to the current JMF670H controller and differs by offering support for TLC NAND, made possible by its improved error-correcting code engine. The JMF680 will also feature Write Booster, JMicron's own SLC cache technology that boost performance when paired with TLC NAND, which typically suffers from poor write performance. The JMF680 features a four-channel design and is targeted at mainstream users. Like the Silicon Motion SM2256, the JMicron JMF680 was designed to be extensible, so it will also be able support 3D Vertical NAND in future.

MASTERING 4K TV JARGON

by *Ng Chong Seng*

Is buying a 4K TV as simple as ensuring that it has a 4K resolution? Not quite, especially if you want your multi-thousand-dollar investment to last as long as possible. Whether you're looking for a new 4K TV or wondering if your existing one conforms with the latest standards, understanding terms like HDCP, HDMI, HEVC and UHD is invaluable. Here's the skinny.



PICTURE SAMSUNG

HDCP 2.2

Most 4K TVs support something called HDCP, which stands for High-bandwidth Digital Content Protection, but only the more recent ones come with HDCP 2.2, the latest generation content protection mechanism. Simply put, HDCP attempts to secure the connection between the source and display (and anything in between); and expectedly, the protection system is the strongest yet in version 2.2.

Now, HDCP 2.2 is really designed for 4K content, so you're fine if you think you're going to stick with 1080p all the way. But there will be a problem if you've a 4K source device (e.g., a Blu-ray player) or service that's HDCP 2.2-compliant and is trying to send protected 4K signals to a non-HDCP-2.2 4K TV. The TV would most likely show a blank screen. To make matters worse, non-HDCP-2.2 devices can't simply be upgraded to support HDCP 2.2, because specific hardware is required.

In short, if you're buying a new 4K TV (or home theater projector or receiver) today, it's of your best interest to make sure that it supports HDCP 2.2. Many consumers like to buy from second or third-tier brands because they're usually more affordable; and while there's nothing wrong with that, be mindful that such TVs often lack the latest features like HDCP 2.2.

For early adopters who've bought a non-HDCP-2.2 4K TV, unfortunately, there's nothing you can do. But now that you know what it is, don't be too surprised if some 4K content won't display properly on your TV some point down the road.



Because HDCP 2.2 is very new and often used as a selling point, manufacturers would usually indicate which connections on their devices support it.

HDMI 2.0

Early and cheap 4K TVs typically come with HDMI 1.4, and while it supports 4K just fine, it has a framerate limit. To be more precise: 30 frames per second for 3,840 x 2,160 and 24fps for 4,096 x 2,160.

HDMI 2.0 is designed to support higher bandwidth (up to 18Gbps) than 1.4, and as a result, it's able to do 4K at framerates up to 60fps. Other features include options for the Rec. 2020 color space, 4:2:0 chroma sub-sampling, up to 32 channels of audio, 21:9 aspect ratio, dual video streams, and improved 3D and CEC functions. HDMI 2.0 is also backwards compatible with HDMI 1.x.

In a nutshell, HDMI 2.0 can only get more important as more 2160/60p content arrives. For futureproofing's sake, there's no reason to omit it if you're buying a 4K TV (or receiver) today. Some early 4K TVs are able to upgrade from HDMI 1.4 to 2.0 through a firmware update, but that is not a guarantee and really depends on the manufacturer.

Also, while HDMI 2.0 and HDCP are often mentioned in the same breath, know that one doesn't equate the other. Although it's possible to upgrade from HDMI 1.4 to 2.0 through a software update, the same doesn't apply for HDCP 2.2 (see above). In addition, if a 4K TV supports HDMI 2.0, it doesn't mean it also supports HDCP 2.2.

For those interested, the latest HDMI version now stands at 2.0a, with high dynamic range (HDR) video support the major new feature added.



While HDMI 2.0 is a real standard, don't get cheated to buy an expensive HDMI 2.0 cable, because there's no such thing. A regular High Speed HDMI cable is all you need.

PICTURES **YAMAHA, AMAZON, NETFLIX** ILLUSTRATION **IANCHONG**

HEVC

HEVC/H.265, or High Efficiency Video Coding, is a compression standard that succeeds the MPEG-4/H.264 AVC standard. Expectedly, it's much more efficient (almost 200%) than its predecessor, which becomes important when dealing with high-res, high-bandwidth 4K content. As such, HEVC has become the go-to compression scheme for 4K streaming services, like those from Netflix, Amazon, and M-Go.

The good news is unlike 4K TVs sold in 2013 and early 2014, recent 4K TVs from name-brand makers mostly come with a built-in HEVC decoder, so they shouldn't encounter any hiccups when playing HEVC-compressed 4K streams. That said, it's still possible for a HEVC decoder-equipped 4K TV to not playback HEVC 4K content, something we saw on the 2014 Panasonic AX800/802 series. In this particular case (which was resolved in October 2014 through a firmware update), they weren't able to play Netflix's 4K content because the TVs' processing chip didn't meet Netflix's certification requirements.

At the moment, we aren't aware of any HEVC problems in any of the latest 4K TVs made by name-brand TV manufacturers. If anything, check if HEVC is supported if you're buying a model in their lower-end series. Again, be more careful with off-brand 4K sets, because their makers are less likely to be as enthusiastic with regards to such certification.

For those who have bought a 4K TV in 2013, you could be out of luck, unless you've one of LG's earliest 4K TVs that came with a built-in HEVC decoder, or a Samsung 4K TV, like the S9 and F9000. The latter didn't come with HEVC support, but it can be added easily via Samsung's external One Connect upgrade box.



4K streaming services such as Netflix tend to use HEVC, so your TV needs to have an HEVC decoder to show the content properly.

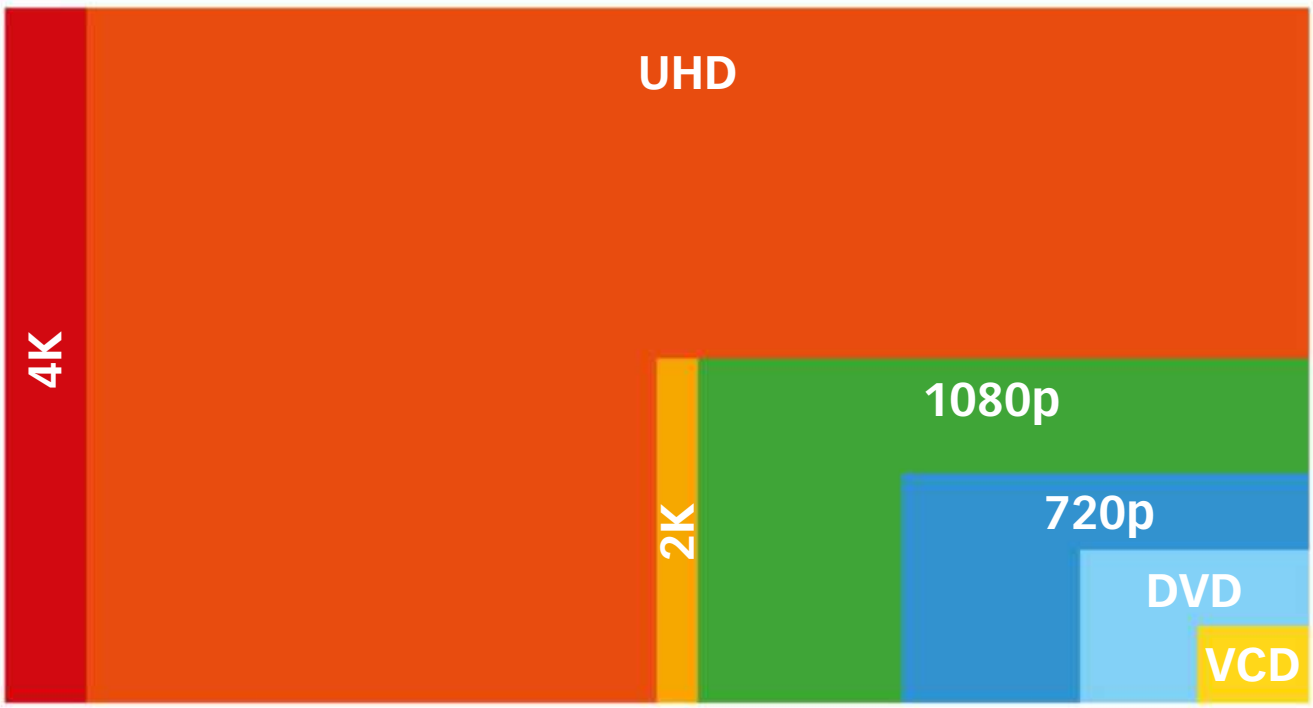
UHD

Strictly speaking, a 4K TV that has a resolution of 3,840 x 2,160 pixels (or 2,160p) should really be called a UHD (Ultra-High Definition) TV or 4K UHD TV to avoid confusion with the DCI (Digital Cinema Initiatives) standards, the latter of which are specs defined for digital cinema production and projection systems.

Standards and trade bodies like the Consumer Electronics Association (CEA) in the U.S. and Digital Europe in Europe have also gotten into the act of defining 4K for consumer products and coming out with their own standardization logos. Both organizations agree that 4K UHD has a pixel count of 3,840 (horizontally) and 2,160 (vertically), and there must be 8 million addressable pixels (3,840 x 2,160) that use an red-green-blue (RGB) sub-pixel layout.

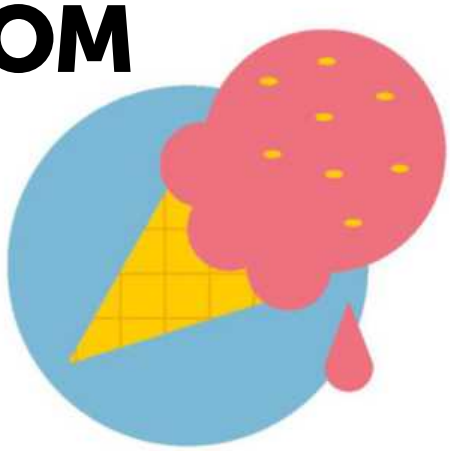
Which brings us to the brouhaha that started last year with regards to whether a 4K panel using a red-green-blue-white (RGBW) sub-pixel arrangement can be considered a true 4K UHD TV. Commonly found in China, these cheaper RGBW-based LED-LCD 4K TVs use a fourth white sub-pixel, which results in lower energy consumption without sacrificing brightness. However, due to the pixel arrangement and the fact that each pixel isn't made up of three colored sub-pixels, image quality may take hit as their resolution and color accuracy aren't as good as 'true' 4K panels using a RGB matrix.

At the end of the day, it boils down to the question of whether you can see the difference. The danger is more with 4K TVs using RGBW panels sourced from unknown suppliers, because for these panels, you'd never know the ratio between the RGB and white sub-pixels. This is yet another reason why we always recommend buying from reputable TV makers.



The TVs that we colloquially call '4K TVs' should really be called 'UHD TVs' or '4K UHD TVs' to avoid confusion with DCI 4K standards.

KEEPING BOREDOM (AND THE HEAT) AT BAY



by *Koh Wanzi*

If you lived in the northern hemisphere, you'd probably be getting ready to welcome Fall in its full glory. Can anyone ever tire of 15°C weather and trees all ablaze with patches of gold and vermillion? But in this land of eternal sunshine, it's more of the same stultifying year-long heat. Here are some fun apps to help you avoid thinking about the summer that never ends.

SWING COPTERS

iOS, Android, Windows Phone
Free



Remember Flappy Bird? From creator Dong Nguyen comes Swing Copters, an even more challenging and infuriating game that makes Flappy Bird seem like a piece of cake. You control a bug-eyed figure that progresses vertically instead of horizontally. Tapping on the screen changes the direction of your character and you have to avoid various stationary and moving obstacles along the way. Sounds like Flappy Bird, but with a different orientation? Wrong. Your copter-equipped pal careens haphazardly across the screen, even when you're not tapping. You'll be tearing your hair out, but you'll keep coming back anyway.

TIMBERMAN

iOS, Android, Windows Phone
Free



The name says it all. You play a timberman on a mission to chop wood. The game works by tapping on either the right or left of the screen to get wood and dodge branches. Modeled after old school arcade style games, Timberman's nostalgic graphics only add to its appeal. You'll be able to chop your way through four variable environments and unlock up to 21 timberman characters as you progress. The creativity on display here sure elicits a chuckle – you'll get to play as Bulk (The Hulk), a cute caricature of President Obama, and even Jason from Friday the 13th!

QUIZUP

iOS, Android, Windows Phone
Free



Gather round, trivia lovers. QuizUp is a multi-player trivia game that allows you to challenge friends or strangers on your own special topic of interest, ranging from things like American history to Harry Potter. To make things more interesting, each player gets a time bar that slowly runs down, so you can't take too long to answer a question. And if you really are sure of your stuff, you score extra points for beating your opponent to the punch. There's also a social aspect to the app – it allows you to find people based on age, location and interest and strike up conversations with like-minded folks.

500PX

iOS, Android
Free



500px is collection of stunning photos from one of the world's most dynamic photography communities. The wide range of photos means that you don't have to be a camera nerd to appreciate them. Anyone with a modicum of taste and an appreciation for beauty will truly enjoy what 500px has to offer. From portraits to natural landscapes and urban jungles, you get to see the world through the eyes of a global community. And because it's community driven, you get to browse through community-selected galleries and curated selections. Not a bad way to kill time at all!



You navigate by tapping the screen to change direction and avoid obstacles.



Your goal is to collect lumber while dodging branches by tapping on either the left or right of the screen.



A time bar at the side indicates how much time you have left to answer the question.



The app shows you a nice tiled layout of pictures in a specific category.

PICTURES **SWING COPTERS, TIMBERMAN, QUIZUP, 500PX** ILLUSTRATION **IAN CHONG**

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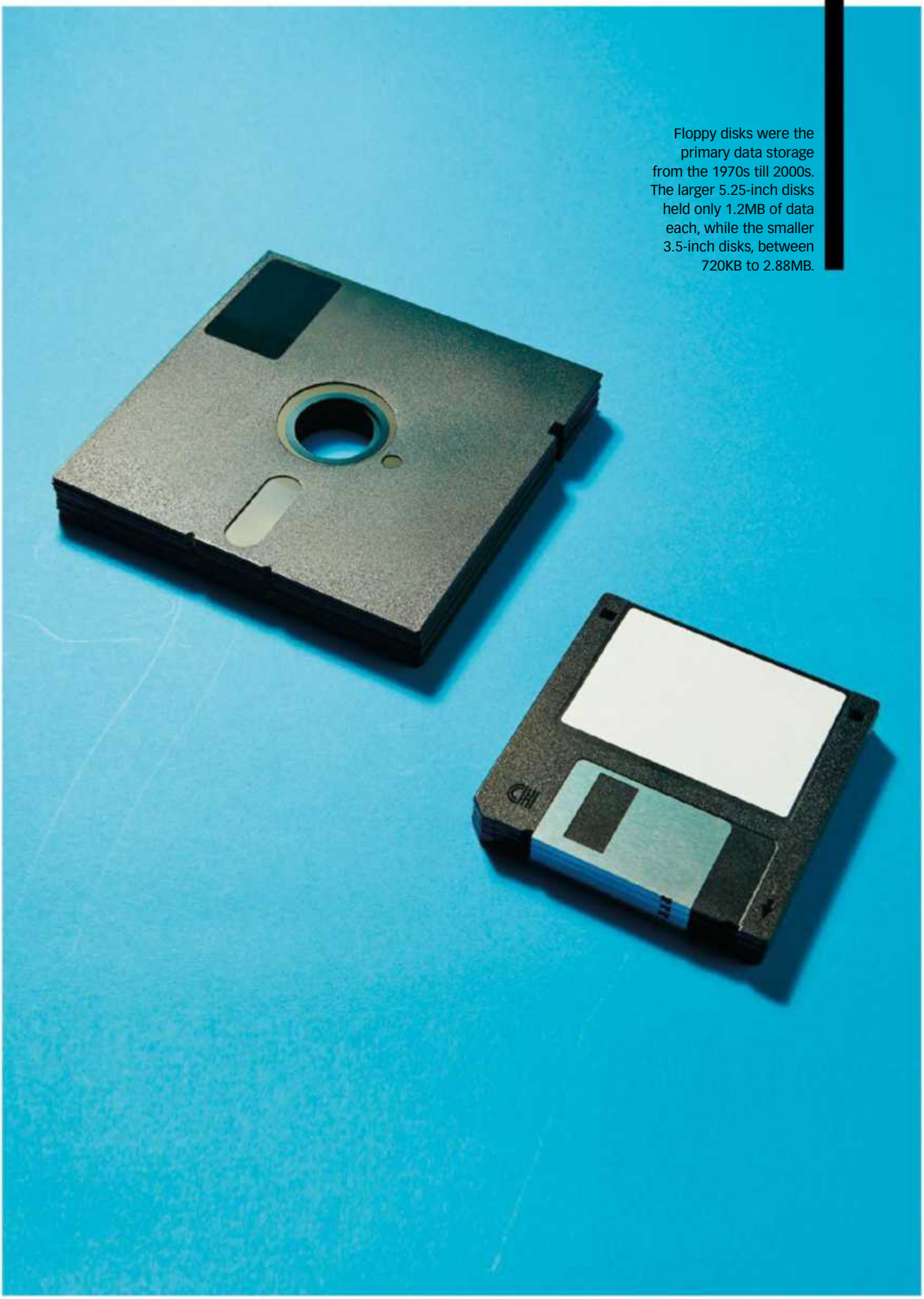
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Floppy disks were the primary data storage from the 1970s till 2000s. The larger 5.25-inch disks held only 1.2MB of data each, while the smaller 3.5-inch disks, between 720KB to 2.88MB.

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